A UNITED STATES DEPARTMENT OF COMMERCE PUBLICATION

Commercial Fisheries REVIEW

U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
National Marine Fisheries Service

JAN.-FEB. 1972
VOLUME 34
NUMBERS 1-2

Commercial Fisheries REVIEW

A comprehensive view of United States and foreign fishing industries — including catch, processing, marketing, research, and legislation — prepared by the National Marine Fisheries Service.

CONTENTS

COVER: The start of a set. Skiff has been dropped and net drum is free wheeling. See article p. 23.

(Photo: R. Green)

FISHERMEN'S MEMORIAL - GLOUCESTER, MASS.

U.S. DEPARTMENT OF COMMERCE
Peter G. Peterson, Secretary

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
Robert M. White, Administrator

National Marine Fisheries Service
Philip M. Roedel, Director

Address correspondence and requests to: Commercial Fisheries Review, 1801 North Moore Street, Room 200, Arlington, Va. 22209. Telephone: Area Code 703-557-9066.

Use of funds for printing this publication was approved by the Director, Bureau of the Budget, April 18, 1968.

Editor: Edward Edelsberg

Production: Alma Greene

For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402. Price 60 cents (single copy). Subscription price: $7.00 a year; $2 additional for foreign mailing.

NMFS — NEW DIRECTIONS

Philip M. Roedel, Director
National Marine Fisheries Service
National Oceanic and Atmospheric Administration
U.S. Department of Commerce

In the October 1970 issue of COMMERCIAL FISHERIES REVIEW, I discussed the new responsibilities the National Marine Fisheries Service would assume as we became part of the National Oceanic and Atmospheric Administration. At that time I promised to discuss with you, in a subsequent issue, what we would do to reshape our organization for its vital role in NOAA.

The year 1971 was one during which the National Marine Fisheries Service underwent major changes in organization. These changes responded in part to long-standing criticisms of the organization of NMFS' predecessor agency, the Bureau of Commercial Fisheries, and in part to our new role as an element of NOAA and our new responsibilities to marine recreational anglers.

ORGANIZATION

The restructuring of NMFS could have taken any one of a number of forms. The one adopted represents the consensus of those in NOAA and NMFS who are most concerned; its implementation is now virtually complete. The restructuring is not simply a matter of reshuffling. Rather, it represents departure from the past, and reflects a basic change in philosophy and a response to that change in terms of organizational structure.

The major aspects of the new organization are these:

1. The primary functions of NMFS have been assigned among three areas, those concerned with Resource Research, Resource Utilization, and Resource Management. Each is headed by an Associate Director.

2. We have created a small number of fishery research centers by combining the administrative and program functions of similar biological laboratories.

3. The centers concerned more with oceanic programs, national in nature, report to the Associate Director for Resource Research rather than to a Regional Director.

4. The centers and laboratories concerned chiefly with inshore programs, local in nature, report to the Regional Director concerned.

5. We have integrated into this system the marine game fish laboratories, which came to us from the Bureau of Sport Fisheries and Wildlife when NOAA was established.

6. We have placed the fishery products technological laboratories under the Associate Director for Resource Utilization.

7. Finally, we retained the basic regional structure with the Regional Directors continuing as the key NMFS representatives in their geographical areas of responsibility. The Directors of Centers who report administratively to the Central Office also serve as senior scientific advisors to the Regional Directors.

A major criticism of the old system was that there were too many small laboratories, some without sufficient budget or staff to operate effectively as independent units. Another major criticism was that the essentially regional approach to, and control of, research programs made development and implementation of national programs a monumental job. The center concept responds to the first criticism, and the national control of some of the centers to the second.

There are four major fisheries research centers concerned primarily with high-seas research carried out as part of nationwide programs designed to solve problems of a national or international nature. The lead laboratories of these centers are located in Seattle, Washington; La Jolla, California; Miami, Florida; and Woods Hole, Massachusetts. These centers, and the Atlantic Estuarine Fisheries Center at Beaufort, North Carolina, report to the Associate Director for Resource Research.

Two centers, with headquarters in our laboratories in Galveston, Texas, and Sandy Hook, New Jersey; and two laboratories at Tiburon, California, and Auke Bay, Alaska, are concerned chiefly with inshore and estuarine research and with programs and problems that tend to be regional in nature. These report to the Regional Directors.

MAFAC and NACOA

In March of last year the Secretary of Commerce announced formation of a Marine Fisheries Advisory Committee (MAFAC), composed of 27 leaders in both commercial and sport fishing activities and from the academic community.

The Committee, which meets three times a year, advises the Secretary on the Department's responsibilities for fisheries resources, and it reviews and advises him on the adequacy of our programs in NMFS and on related programs in NOAA. With such a limited number of members, not all facets of our fisheries can be represented on the Committee at any one time.

However, the Committee Charter specifies that the membership will rotate with vacancies occurring annually, and all segments will be represented over a period of about 3 years.

The second group was appointed by the President on October 19, 1971, to serve as members of NACOA, the new National Advisory Committee on Oceans and Atmosphere. William Nierenberg, Director of Scripps Institution of Oceanography, was designated Chairman, and William J. Hargis, Director of the Virginia Institute of Marine Science, Gloucester Point, Virginia, was named Vice Chairman. The Committee is charged with undertaking a continuing review of the progress of the Nation's marine and atmospheric science and service programs. It also advises the Secretary of Commerce with respect to the administration of NOAA. This group will submit its first report to the President by June 30 of this year. Several members of this Committee are from the fishing industry and one is also a member of the Marine Fisheries Advisory Committee.

So much for the reorganization and growing pains that have concerned NMFS during the past year. While the reorganization was taking place, we were simultaneously defining program areas. I would like now to touch on the more significant of these.

NEW PROGRAMS

Biological Research

Our biological research program is now undergoing what we like to regard as a healthy change from the past. We have recognized for a number of years that we lack adequate resource and environmental data for short-term and long-term assessments of the condition of our marine resources--and the physical, chemical, and biological events that affect their well-being. In an attempt to cope with this, we have recently launched a coordinated national effort called the Marine Resources Monitoring, Assessment, and Prediction Program (MARMAP). What we intend to do in MARMAP is to carry out intensive surveys of ichthyoplankton, groundfish, pelagic fish, and environmental conditions using standardized methods.

This program is designed to give us the basic data prerequisite to: (1) better management and allocation of resources, and improved regulation of exploitation to insure optimum yields and economic returns; (2) protection of resources from damage by pollution; (3) decisions on multiple uses of the marine environment; (4) utilizing new living marine resources; and (5) providing fishermen with real-time information on locations of fish concentrations to reduce search time and, as a result, reduce the cost of fishing.

MARMAP is thus designed--in combination with our population dynamics and other biological programs--to give us reasonably accurate estimates of the abundance, distribution, susceptibility to capture, and status of all stocks of actual or potential interest to American fishermen. Information of this sort is a prerequisite if we are to be successful at the international bargaining table and if we are to be able to develop rational management schemes at home.

While MARMAP is the largest single new element of the biological research program, it is not the only one.

Projects concerned with environmental quality will play a much larger role in the future of NMFS. MESA--Marine Ecosystem Analysis--is the NOAA-wide program covering this broad area. So far as living marine resources are concerned, we will be, among other things, gathering baseline ecological information with particular respect to nearshore waters, determining the effects of environmental changes on marine organisms, developing means of rehabilitating damaged environments and, most importantly, providing a review and advisory service in the general area of Federal water resources planning.

We are also increasing our efforts with respect to sport fish research. At present, we are concerned especially with the development of a sound statistical program and with augmentation of the more traditional studies of life history, migratory patterns, and the like.

State-Federal Program

The State-Federal Fisheries Management Program is now being implemented. I regard this program as the most significant new step of the National Marine Fisheries Service.

Specifically, the State-Federal initiative is our response to two matters of concern. The first relates to the common-property nature of fishery resources. In effect, this means that until they are captured fish belong either to no one or to everyone, depending on your social philosophy. The end result is the same: fishermen have no property rights to these resources. When this is coupled with the absence of limitations on the entry into a fishery, there is a natural tendency to overcapitalize a growing fishery. The result, particularly if the fishery declines, is too many units of gear, too many fishermen, too many boats, too much capital, or all of these.

The second problem stems in part from the first: in the United States, each State has reserved to itself the right to manage its living resources. This has led to a multitude of management systems--each tailored to the needs of a given State but very few tailored to the needs of the fish stocks, which are no respectors of State or national boundaries. Further, the managerial schemes tend to take the form of instituting inefficiencies thru such means as gear restrictions rather than dealing with the real problem of too many

fishermen pursuing too few fish. The State-Federal Fisheries Management initiative proposes to deal with these two problems by developing an effective management plan that will assure the rational use of fishery resources for both sport and commercial purposes.

We are dealing basically with allocation conflicts. Some of them involve different countries fishing the same resource. Some of them are between States in the contiguous fishery zone. Some of them involve disputes between commercial and recreational fishermen. Some of them are among groups of fishermen fishing the same resource but with different gear. And some of them are between fishermen of all sorts on the one hand and competitors for use of the environment on the other.

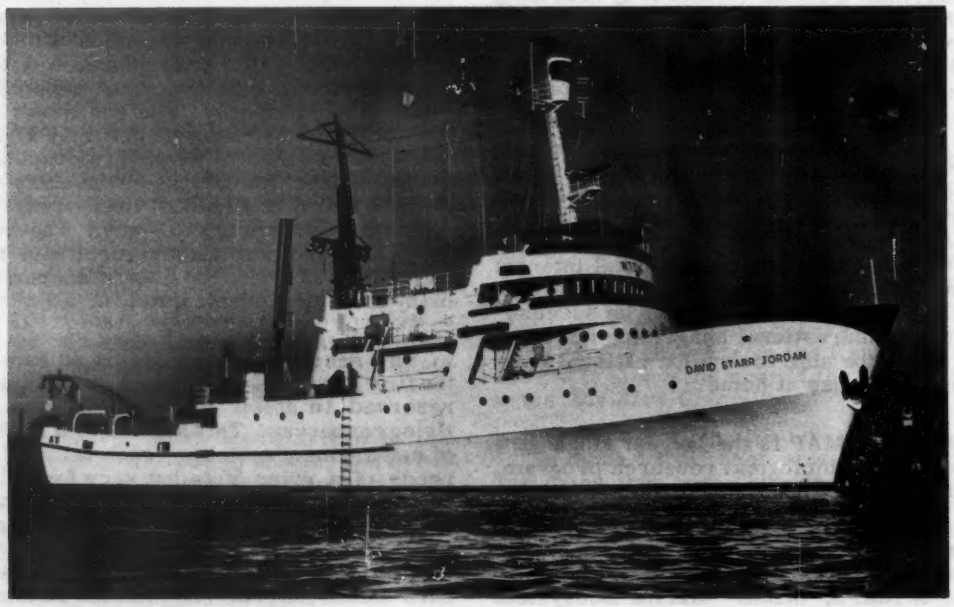
These conflicts may relate to individual States or local areas, but many of them involve more than a single State and are beyond the ability of the States alone to resolve.

Our present institutional arrangements for managing fisheries are simply not adequate. Everyone, whether he works at the local, State, national, or international level, is aware of these deficiences.

Until now, the approach of the Federal Government seems to have been one of accepting the institutional setting as it existed and of working within these constraints.

This approach has not worked, especially in commercial fisheries, and we are convinced it never will work. Unless we, in cooperation with the States and others, can bring about the necessary mechanisms to cope better with these growing allocation problems, we will continue to see increasing difficulties in controlling fishing effort and in preventing destruction of our resources.

I believe the reorganization we have undergone and the new programs we have initiated have made NMFS a viable and responsive organization. In the first years of our second century of service, with your help, we will make great strides toward fulfilling our mission.



The NMFS 'DAVID STARR JORDAN' will be used this year in the Eastern Pacific between Oregon and Mexico to conduct MARMAP Ichthyoplankton surveys. It will perform sonar assessments of pelagic resources and physiological studies of large pelagic fish.

DR. WILLIAM ROYCE NAMED NMFS ASSOCIATE DIRECTOR

Dr. William F. Royce, Associate Dean of the School of Fisheries, University of Washington, Seattle, since 1967, has been appointed NMFS Associate Director for Resource Research.

Dr. Royce has overall responsibility for managing resource research and development at NMFS Fisheries Centers--about 50 laboratories and field stations and 30 research vessels. More then 775 scientific, professional, technical, and support personnel are involved in resource research activities.

Dr. Royce served the Federal fishery service from 1942 until 1958. He left to become professor of fisheries and director of the University of Washington's Fisheries Research Institute. He has been adviser to developing nations in Africa, Latin America, and the Middle East, to the UN's Food and Agriculture Organization on fishery education and training programs in East Africa, and to the U.S. section of the International North Pacific Fisheries Commission in problems concerning salmon.

Dr. Royce, 56, was born in DeBruce, N.Y. He earned his B.S. in 1937 and Ph. D. in 1942 from Cornell University, Ithaca, N.Y. His major graduate study was vertebrate zoology. He did graduate work in mathematics at the University of Hawaii, and in statistics at the University of Florida.

He is author of 60 professional publications, including a textbook, "Introduction to the Fishery Sciences." He is a Fellow, American Association for the Advancement of Science, American Institute of Fishery Research Biologists, and the International Institute of Fishery Scientists. Dr. Royce is a member of 9 technical societies.

WHITELEATHER RETIRES FROM NMFS

Richard T. Whiteleather, who served the U.S. for 36 years, retired Jan. 14, 1972, as Director of the NMFS Southeast Region.

He was a specialist in fishery-resource development and an administrator. He had directed Federal fishery activities in 17 states, Puerto Rico, and the Virgin Islands.

The recreational and commercial fisheries of the southeast are the most valuable in the United States. More than 40% of U.S. seafood production comes from there. It is the center for research on several valuable coastal fishery resources, particularly shrimp and menhaden.

GEHRINGER REPLACES WHITELEATHER

Jack W. Gehringer, 48, has been named Director for the Gulf and South Atlantic Region of the National Marine Fisheries Service (NMFS). He served as an associate director there since April 1970.

Gehringer is a native of Papillion, Nebraska. He received his B.S. in fisheries from Colorado A&M College in 1950. He has spent his entire Federal career in the Gulf and South Atlantic Region. He began serving NMFS (formerly Bureau of Commercial Fisheries) in 1950 as marine biologist in the Galveston, Tex., laboratory. In 1952, he transferred to the Brunswick, Ga., laboratory, where he served as program leader, assistant laboratory director and, later, as acting laboratory director. Early in 1969, he was assigned to the regional headquarters in St. Petersburg, Fla., as acting deputy director.

NMFS RESEARCH LEADS TO WORLD'S NO. 1 PILOT SALMON FARM

Salmon research by scientists of the NMFS Northwest Fisheries Center (NFC) has led to establishment of the world's largest pilot commercial salmon farm near Seattle, Wash. The farm's winter-spring (1971-72) production is approaching 100 tons.

NFC has conducted research in marine aquaculture (mariculture) for 2 years at its Manchester, Wash., station, which opened July 1969. The station's most prominent research is on one NMFS mariculture program--the saltwater rearing of Pacific salmon in floating pens.

The research station is situated ideally for its mariculture research. It is about 10 miles from Seattle on Clam Bay along Puget Sound's west shore. The area boasts a variety of habitats: Beaver Creek, a freshwater stream; exposed tidal flats; and deep, well-circulated salt water.

The Researchers

Dr. Timothy Joyner is program supervisor. The salmon research is conducted by Conrad Mahnken, oceanographer; Anthony Novotny, fishery biologist; and James S. Johnson and Gunnar Safsten, fishery technicians. In 2 years, these researchers showed that it was economically feasible to rear coho and chinook salmon in saltwater pens. They grew coho in pens resting on the bottom in about 40 feet. They raised many coho through maturity. They cooperated with Washington State's Department of Fisheries to increase the number of salmon for Puget Sound's recreational fisheries.

Two-Phased Studies

There were 2 phases in the Manchester studies on the feasibility of rearing salmon for market. The first was pioneering research of NFC's salmon-culture project to develop an economical system for raising salmon from hatching to market size or maturity. The second was an experimental pilot farm financed partly by NOAA's Office of Sea Grant.

Scientists of the salmon-culture project concentrated on rearing coho salmon. In 1969, they put 10,000 fingerlings in a plastic, meshed cage and floated it in Puget Sound. The fish grew well in salt water; their survival was high. The food conversions were excellent: 1.5 lb of feed for 1 lb of fish weight on the Oregon Moist Pellet (OMP) diet until the fish reached 1 lb.

Would the market and consumer accept the larger coho? The NMFS Marketing Division studied this. It received enough favorable comment to justify a closer look at the commercial feasibility of raising on a large scale 8 to 12 oz salmon (dressed weight).

Many Firms Interested

This initial NMFS research stimulated interest by many firms in commercial culture of salmon. Ocean Systems, Inc. (OSI), a subsidiary of Union Carbide, asked support from NOAA's Office of Sea Grant for a pilot project in Puget Sound. It received $100,000 in matching funds for a 1-year study. The principal objective was to encourage the development of mariculture in Washington State by demonstrating the technical and economic feasibility of such an operation.

OSI purchased 700,000 coho salmon eggs from Washington State in November 1970. "The eggs were incubated and hatched, using water from Beaver Creek, at a small building donated to NMFS by the U.S. Navy. Incubation was accelerated by holding the temperature at 10°-12° C with an oil-fried furnace."

About 400,000 eggs hatched in the winter. In early February 1971, the fry were moved from the hatchery to a freshwater pond. An adjoining pond was stocked with about 464,000 fall chinook salmon fry obtained from the University of Washington. The coho were fed only dry diets; the chinook were fed dry and moist (OMP) diets.

Saltwater Nursery Pen

The chinook salmon at 80/lb were trucked back to Clam Bay in late May and placed directly into a saltwater nursery pen. The pen was 30 x 30 x 15 ft deep and held 385,000 fall chinook. The diet was OMP. Treatments with medicated (terramycin) feeds became necessary in early June when mortalities from Vibriosis, a bacterial disease, began to increase. In June, 10.5% of the fish were lost.

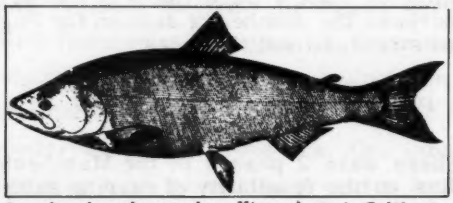
The coho salmon were graded in early July, when about 60% were smolted and weighed 25/lb. Then the coho were transferred to 4 growing pens (50 x 50 x 30 ft deep) designed for larger fish. In one pen, 158,000 coho reached a density of 1.8 lb/cu ft just before harvest began in late December; there were no adverse effects on survival, food conversion, or growth rate. The researchers say that at this density 700,000 lb of coho could be grown in 1 year in 1 surface-acre of water (30 ft deep), including the large raft support system; at harvest, their total weight would be about 2.5 million lb.

Conversion of feed by the coho salmon has averaged 1.1:1 (including mortalities) on a dry diet. Chinook salmon have not grown as rapidly. Conversion of feed by chinook throughout the study has averaged 1.7:1 (including mortalities) on mixed dry and moist feeds. Nearly a year after hatching (350 days) the coho are getting too large for market. During the peak growing period, September through November, a feed ration of 3% of body weight per day produced a 3% increase in weight per day. Many fish 13-14 inches long that weigh about 1.5 lb have been set aside for future brood stock.

Ready for Market

In December 1971, the first coho from the pilot farm were ready for market at a dressed weight of 11-12 oz. The chinook were expected to be ready in March 1972. The coho are being harvested at rate of 8,000 to 15,000 lb/week. The fish are killed in -1.5° C water and transported to Marysville, Wash., for processing by Pan-Alaska Fisheries, Inc. All fish are sold through Swiftsure Fisheries in Seattle. They bring $1.35-$1.70 per lb wholesale. Fish quality is excellent. There has been substantial interest among U.S. and foreign markets in 11-12 oz salmon. On Dec. 24, 1971, for example, Swiftsure received an order from a food service for international airlines for 5,000 lbs of salmon to be delivered as soon as possible, and for 10,000 lbs to be delivered each month thereafter.

In December 1971, also, Union Carbide announced plans to form a new subsidiary for its sea farming operations, effective Jan. 1, 1972. Dom Sea Farms, Inc., will operate independently of Ocean Systems, Inc., and concentrate exclusively on mariculture. Over 2 million salmon eggs purchased from Washington State are now hatching at Dom Sea's new freshwater facilities near Silverdale, Wash. Saltwater rearing schedules and past experience indicate a projected harvest of 400-500 tons in 1 year.



Oncorhynchus tshawytacha. King salmon in California, chinook in Alaska.

1971 ALBACORE LANDINGS DECLINE FROM 1970

Preliminary figures on west coast landings for the 1971 albacore season are about 54 million pounds (27,000 tons). In 1970, 58 million pounds (29,000 tons) were landed. The 1961-1970 average was 47 million pounds (23,500 tons). The following report was provided by R. Michael Laurs, Leader, Fishery-Oceanography Group, NMFS Southwest Fisheries Center, La Jolla, Calif.

Laurs states: "The relatively high 1970 landings probably reflect increased fishing effort. Although exact data are not available, rough weather during parts of the season and unavailability of fish near the normal end of the season tended to limit fishing activity and success for individual boats."

Preliminary California landings for 1971 were 30 million pounds, about the same as 1970. The aggregate Oregon, Washington, and British Columbia landings were 23.4 million pounds, down about 16% from 1970. British Columbia landings set a record.

	1971	1970	1969
California	30.0	29.9	14.7
Oregon	16.8	21.8	29.8
Washington	2.9	4.3	3.5
British Columbia	3.7	1.6	2.5

Highlights of 1971 Albacore Season

In February 1971, a small number of 2-3 pound albacore were caught near Uncle Sam Bank. These fish were thought to be young of albacore that remain in this area throughout the year. The first report of a migrating albacore caught in the West Coast fishery for 1971 was on June 25: Oregon State University's R/V 'Yaquina', on an oceanographic cruise, landed a 14-pound fish in 59° F waters about 420 miles west of Cape Blanco, Oregon. A day later, sport boats and private yachts reported albacore caught near the Sixty Mile Bank off San Diego, Calif. Sport boats off southern California continued to fish with success from San Clemente Island to the 213 fathom spot, and from 35 miles southwest of Point Loma to the dumping grounds on 12-18 pound fish. Sport boats out of San Diego had good fishing throughout July.

'Jordan' Checks Migration Route

The NMFS 'David Starr Jordan' left San Diego June 28 on a 19-day albacore-oceanography cruise. Its mission was to investigate the migration route of albacore when they enter the North American fishery near the season's beginning. Jordan made its first catches on June 30 about 200 miles west of San Diego on the cruise track to the study area, along longitude 135° W between latitudes 33° and 41° N. Catches along 135° W suggested a southerly distribution of fish.

On July 2, an albacore price settlement of $630 per ton delivered to the canneries was reached. Also, the canners agreed to pay $10 per ton for use in albacore research and scouting. Although the settlement was the earliest in 3 years, most of the fleet did not begin fishing until the second week of July.

As Season Developed

As the boats moved to the fishing grounds, two widely separated fishing areas developed. One was from San Clemente Island to Geronimo Island, Baja California; the most successful location was about 20-40 miles offshore, between Cape Colnett and Geronimo Island. The fishery off Baja California was the best in this area since 1967. On July 5, the 'Sunrise', on a chartered cruise for the Oregon Fish Commission, indicated commercial quantities of albacore 120 miles off Cascade Head to Reedsport in 57°-59° F waters. Boats had good catches there until July 13. The area off Grays Harbor also reported good fishing.

By the end of July, fishing was spotty off Baja California, though deep-running albacore were still present and some bait boats had days of good fishing during the last week of July. As fishing success decreased off southern California, catches increased 50-100 miles west of Eureka on 12-14 pound fish. Also, when weather permitted, boats reported good catches off central California. Fish catch off Newport and La Push increased during the last 10 days of July but dropped on August 1. At the end of July, about 4,000 tons of albacore had been landed on the west coast.

Fishing continued good from Eureka to Crescent City until August 12. Fishing again was reported off Grays Harbor, Cape Flattery, and some off La Push. Except for Cape Flattery area, the fishing in Oregon and Washington was spotty from mid-August until season ended. However, it was learned after the season that Canadian and some U.S. jig boats had very good fishing off Cape St. James on Queen Charlotte Islands for about 2 weeks in August, and good fishing off Vancouver Island's northwest tip during early September and off Estaban Point near end of September.

The Catches of August

By mid-August, the best fishing along U.S. coast was from Morro Bay to Farallon Islands on 9-11 pound fish. Weather continued to affect number of fishing days but, with better weather, a large fleet moved into this area. Average catches were good, but there were very few individual high scores, which was typical of this season's albacore fishery.

Other areas along coast had only spotty catches during last 2 weeks of August. Some fishing was reported in Gorda Seavalley area, but albacore fishing off the southern California area was over by end of first week in August. At end of August, total landings for west coast increased to 12,000 tons.

Most boats fishing off central California in early September were forced into port because of high winds. When winds abated, catches did not reach late-August numbers. Fishing was very spotty on 7-9 pound fish. Spotty fishing continued throughout September all along coast. In September, several boats unloaded fish caught earlier; at end of September, season's total landings were about 21,000 tons.

Albacore Research & Scouting

The American Fishermen's Research Foundation was established by the albacore fishing industry to administer a fund derived from the $10 per ton assessment paid by canners on albacore landed by U.S. fishermen. The Foundation chartered 4 jig boats for albacore research and scouting in cooperation with NMFS La Jolla Laboratory during October. The boats left San Diego October 4. Traveling in pairs, they worked waters out to about 250 miles off west coast between San Diego and San Francisco. Fish were located in relatively large numbers about 175-200 miles off Morro Bay, and in moderate quantities about 150 miles off Point Arguello; however, in most other areas, fishing was slow. The fish located off Morro Bay were small, about 7-9 pounds; those off Point Arguello were of mixed size. Besides trolling for albacore, the vessels collected oceanographic and weather data and tagged 912 albacore. Most of fish tagged, 72%, were 7-8 pounds; 11% were 12-16 pounds. Results of tagging should help NMFS fishery scientists assess proportion of albacore returns to enter U.S. fishery in later years--and what proportion enters Japanese fisheries in central and western Pacific and in coastal waters off Japan. Data collected by the four boats are being analyzed by scientists at the NMFS La Jolla Laboratory.

The albacore season was over by the end of October. Some boats continued to fish, but only small numbers of albacore were caught.

Although exact figures are not available, it appears that more boats fished this season than in past seasons, and that the season was shorter than in 1970. Although total west coast albacore landings were down only slightly from 1970, catches by individual fishermen were estimated to be 5-20% lower.

U.S. & CANADA TO STUDY LAKE ONTARIO

On April 1, 600 U.S. and Canadian scientists and technicians will begin a year-long study of Lake Ontario, the largest investigation ever undertaken of any of the Great Lakes. For 12 months ending March 1973, planes, vessels, buoys, weather stations and balloons will amass data about Lake Ontario and its drainage basin.

The study seeks to analyze completely the lake's biology and physical status--to see how much ecological damage man has inflicted on it, and how future damage can be minimized. The scientists selected Ontario because it is typical of the Great Lakes, excluding Erie. The latter is shallower than the others. What they learn from Ontario may help the other lakes.

The Great Lakes hold about a fifth of the world's supply of unfrozen fresh water.

Deterioration 'Alarming'

Dr. Robert M. White, Administrator of NOAA, which has primary responsibility for the U.S. share of study, said: "Their environmental quality has deteriorated to alarming levels. The Great Lakes and their basins are a high resource vital to the interests and well-being of our two nations. For this reason it is increasingly important that they be managed more effectively."

Lakes' Importance to Canada

J. P. Bruce, Canada Centre for Inland Waters, said 30% of Canada's population and 50% of her industrial production are concentrated in the Great Lakes and St. Lawrence basin. Because of the lakes' importance, they have been studied for at least 10 years, sometimes with U.S. participation.

Although these studies produced much useful information, Bruce noted, they pointed clearly to the need for a much larger effort.

The latest effort is named International Field Year for the Great Lakes. It will cost about $15 million.

U.S. headquarters will be in Rochester, N.Y.; Canada's in Burlington, Ontario.

Background

The project planners said the need for managing the Ontario basin was urgent because: 1) the lake's deterioration was advanced; 2) the coastal region, especially the Canadian, is one of the fastest developing areas of North America. Lake Ontario receives a large load of pollution, mostly from the U.S. side, from Lake Erie and the Niagara River.

Study Goals

The scientists hope that the study findings will lead to better control of pollution, weather forecasting, and better management of lake level and fisheries. Commercial fishing today is in poor condition.

The Study

Smallest of the Great Lakes, Ontario has an area of 7,340 square miles. More than 20 observation buoys and deep-water towers will span it. Five large research vessels--3 Canadian, 2 U.S.--will cruise it. Radar, balloons, and planes will gather data on the basin's atmosphere.

When all the data are processed, the scientists hope to prepare computer models that will predict the effects of proposed changes in the uses or environment of Lake Ontario. Also, they see an early-warning system applicable to the other lakes.

A Soviet Trawler on Georges Bank. (R. K. Brigham)

THE FUTURE OF NEW ENGLAND'S MARINE RESOURCES

Russell T. Norris

To meet our responsibilities in the Northeast Region, we operate research laboratories at Boothbay Harbor, Maine; Gloucester and Woods Hole, Massachusetts; Narragansett, Rhode Island; Milford, Connecticut; Sandy Hook, New Jersey; and Oxford, Maryland. Two high-seas research vessels, the 'Albatross IV' at Woods Hole and the 'Delaware II' at Sandy Hook, and several smaller inshore vessels are utilized by these laboratories. The scientific work in our laboratories is supplemented by such diverse service activities as Enforcement and Surveillance, Statistics and Market News, Economics, Marketing, Financial Assistance, State-Federal Relationships, Water Resource Studies, and Extension.

Although there are many problems facing those interested in the oceans and the utilization of marine resources, I shall discuss only a few of the more important ones--foreign fishing, environmental deterioration, and institutional constraints.

FOREIGN FISHING

We hear much about the great foreign fleets off our shores and probably there is no other single problem which has focused more attention on the ocean. It is indeed a serious matter. The total catch in the Northwest Atlantic increased from 1.8 million metric tons in 1954 to 3.9 million metric tons in 1968. The catch in 1969 decreased slightly, the first time since 1954. The increased catch is almost entirely due to increased fishing by European countries. The United States and Canadian catches in the same period increased from 1.2 million metric tons (67% of total) to only 1.5 million metric tons (38% of total).

Major Fish Stocks

Now what about some of the major stocks of fish? Cod, which has accounted for nearly half the catch in recent years, is now being fished at or beyond the level which will provide the maximum sustained yield. Herring catches increased from 184,000 tons in 1958 to 922,000 tons in 1968, and some stocks of this species are now overfished. In general, the total fish stocks in the Northwest Atlantic cannot withstand further increases in fishing without being overexploited to the extent of reducing actual yields. Specific stocks in waters fished by the United States, some of which form the primary markets in New England, have been affected greatly by increased foreign fishing. I refer especially to haddock and yellowtail flounder.

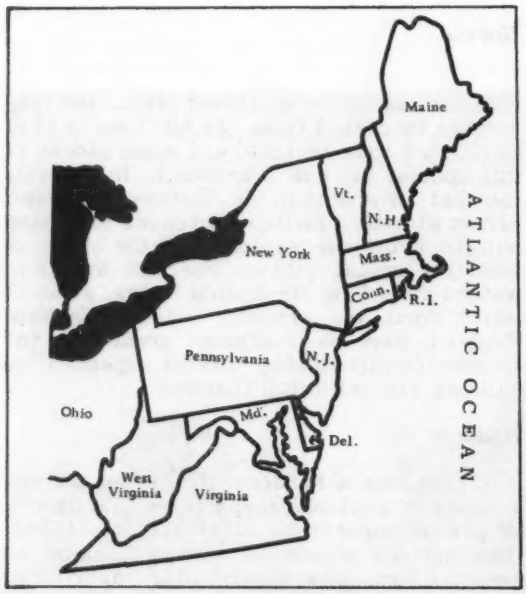
Haddock

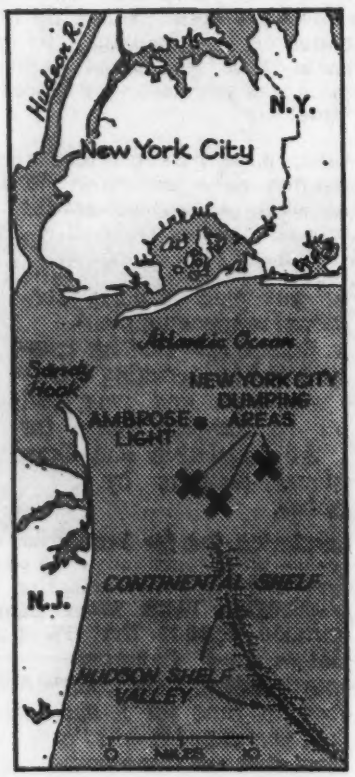
The stocks of haddock off New England and southern Nova Scotia supported a U.S. fishery of prime importance since the late 1920s. The haddock population off New England, on Georges Bank, was of particular importance. From 1935 to 1964, the annual catch taken entirely by U. S. fishermen varied from 30,000 to 60,000 metric tons. By 1961, biological studies indicated that the maximum sustainable yield was about 50,000 metric tons, which was very near the actual catches at the time.

In 1963, production and survival of young fish were extremely good. This very abundant year-class entered the exploited phase in the second half of 1965. The high abundance attracted the Soviet Fleet and, over a period of 18 months, the Soviets caught 180,000 metric tons. A significant part of this catch in 1965 consisted of fish smaller than that taken by the regulation $4\frac{1}{2}$-inch mesh. Thus, the U. S. fishery, which did not start significant exploitation of this year-class until 1966 did not realize very much benefit in increased catch rate.

By 1964, Canada had also increased its fishery on Georges Bank haddock. So, during 1964-1966, the fishing mortality had doubled. Year-class production from 1965 to date has been very poor. The combination of heavy fishing and poor recruitment caused the stock to decline by 1969 to 25% of the level

The author is Regional Director, Northeast Region, NMFS. This article is nearly all of his talk at the Environmental Action Symposium, Museum of Science, Boston, Mass., Dec. 2, 1971.





that produced the 50,000 ton sustained yield. In 1969, the catch with unrestricted fishing was 25,000 metric tons. An international quota was established to limit catches in 1970 and 1971 to 12,000 metric tons. This will be further reduced to 6,000 tons in 1972. Even this limited catch is greater than current production--so no improvement in stock density is expected for several years at least.

Yellowtail Flounder

The stocks of yellowtail flounder off New England have supported a U. S. fishery since the late 1930s. It has been of increasing importance since the late 1950s. From 1961 to 1969, the U. S. catch ranged from 25,000 to 50,000 metric tons, exceeding, in some years, the maximum sustainable yield. Prior to 1969, the foreign catch was small. However, in that year, the foreign catch, essentially Soviet, was 20,000 metric tons. This caused the resulting effort to be double what the stocks can probably support. Strong 1966 and 1967 year-classes have been followed by lesser ones. The increased catch in 1969 would be expected to have reduced the stock size, and the 1970 survey cruises indicate this may be the case.

ENVIRONMENTAL DETERIORATION

Now let us focus on environmental deterioration and its effects on living marine resources. Unfortunately, most of my remarks will deal with areas outside New England, specifically the New York Bight, because our organization has been actively engaged there. However, I suspect that many of the same conditions prevail in New England.

For some time, the New York Bight has served as the ocean disposal area for unbelievable quantities of sewer sludge and contaminated dredging spoils. For example, every day one billion gallons of raw industrial and domestic sewage flows under the Verrazano Bridge (the world's longest suspension bridge connecting Staten Island to Brooklyn--Ed.). This current practice of disposal has had serious effects on the living resources of the Bight. Important bottom-dwelling forage species used as food by finfish have been eliminated from an area of over 20 square miles.

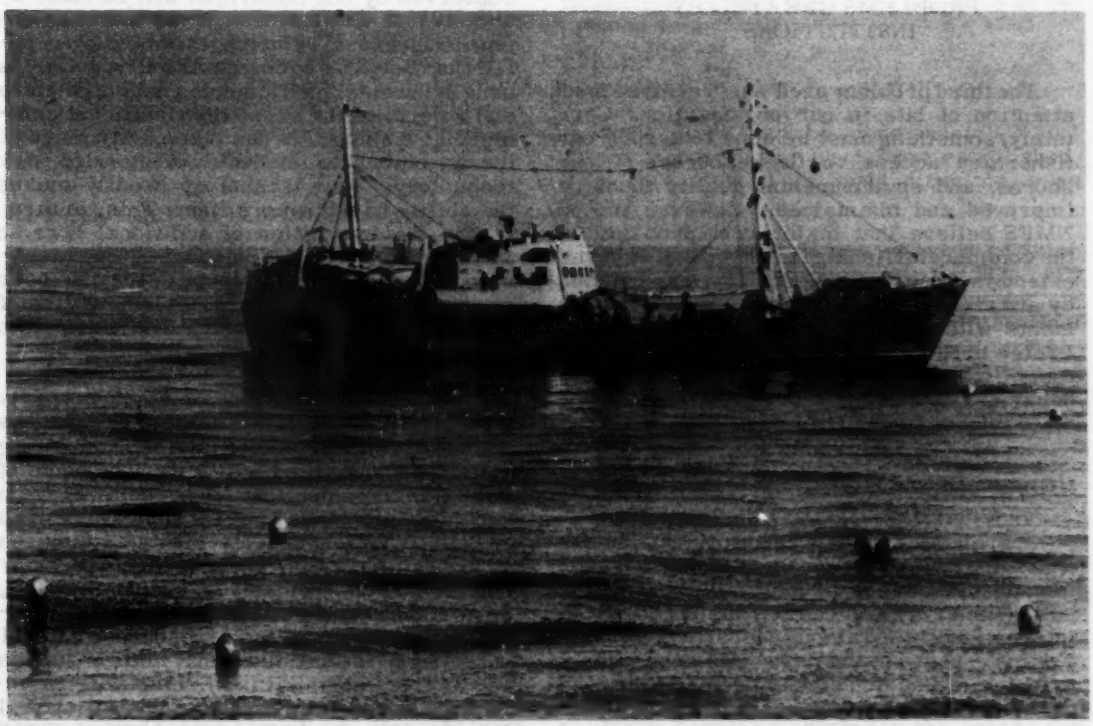
Recently, large areas have been closed to the harvesting of the surf clam, economically one of the Nation's most important shellfish. With its distribution limited essentially to the coastal waters of the New York Bight, this resource is very vulnerable to contamination and subsequent closure to harvesting.

Effects on Marine Life

Even more important than the public health effects of environmental deterioration is the continued gross decline of water quality in estuarine and coastal environments and its effect on their carrying capacity for marine life. This has not occurred without adequate warnings. Government publications in 1887 noted that water quality in Newark Bay (N.J.) had reached a point where fishermen could no longer sell finfish or shellfish taken there--they tasted of coal oil. Three decades later, a Rutgers University (N.J.) professor warned that unless the waters of Raritan Bay were cleared of industrial and domestic wastes--in particular, heavy metals--society would see the decline and disappearance of the oyster beds and other shellfish in that bay. Only a decade later, his prophecy was fulfilled.

Today we witness the exportation of these conditions to offshore coastal shellfish beds and environments. The New York Bight is characterized by sediments containing several hundred parts per million (ppm) of copper, chromium, lead, and zinc. The effects of these metals and other wastes on bivalves, lobsters, crabs, and other invertebrates are not thoroughly understood, but preliminary observations, measurements, and experiments indicate that something should be done now, not a decade from 1971. The earlier unheeded warning should be ample evidence for this.

In addition to the actual contamination of coastal waterways and estuaries in recent years, man has physically damaged these environments through dredging, filling, and



A Soviet drifter-trawler at the Northern Edge of Georges Bank hauls its gill nets. The large balloon floats visible on surface are attached to float lines of nets.

bulkheading activities. In doing this, he conspicuously removed breeding and nursery areas and disturbed shellfish beds. All of this was done in the name of progress or "improving" waste marshland.

Oil on Georges Bank

Coming back to New England, we hear much about oil on Georges Bank. Oil companies are apparently interested in exploring and possibly developing these resources. This is a very complex situation: the oil interests are looking at what are reported to be vast resources--and the fishing industry, already beleaguered with other problems, views oil exploration as a serious threat to its livelihood. It is concerned about possible spills and physical obstructions on the bottom. While these concerns are very real, fishing interests in the Gulf of Mexico have managed to co-exist with large oil and gas developments.

PROBLEMS CREATED BY INSTITUTIONS

The third problem area has received much attention of late in our organization. Certainly, something must be done to assure our fishermen access to the resources off our shores, and environmental quality must be improved and maintained. However, we in NMFS believe that major root problems of the commercial fishing industry, and to some extent the recreational fishery, are created by and are a part of the institutional arrangements within which we must function today. I refer broadly to the established laws, customs, traditions, organizations, and group behavior associated with the utilization and management of our fisheries.

Common Property

One element of this institutional setting which is particularly guilty of creating problems is the common-property basis for allocating fishery resources both among countries internationally and among users domestically. For many years in the past, this open-access principle posed no serious problems so long as there were relatively few people (or countries) interested in fishing what then appeared to be relatively plentiful resources. As the numbers of fishermen and countries who want to fish a rather fixed amount of resources have continued to increase, however, we have experienced some critical allocation problems. At worst, under these conditions of growing numbers of participants, our regulatory mechanism has failed us. We have been unable to control fishing effort and the result has been overfishing. At best, we have been able to control total effort, but we have accomplished this by applying increasingly severe regulations that impose inefficiencies and high costs on too many units of effort. The result has been overcapitalization and depressed economic conditions.

Constraints of Common-Property Status

The common-property status of the resource has constrained us in other ways. It has taken away much of the incentive of the individual in private enterprise to help protect or conserve the resource--for what is conserved by one fisherman will be taken by another. It has instilled in the individual an unwillingness or reluctance to abide by regulations because conservation regulations usually create inefficiencies and high costs and undermine the economic viability of commercial fishing. It has taken away much of the incentive to innovate or develop new technology. New technology usually means the ability to catch more fish. This, in turn, means the imposition of additional laws so that more fish will not be caught. Each technological development in practice has been rendered ineffective by the implementation of offsetting regulations, which are required to protect the resource.

For these reasons, the common-property mechanism for allocating fishery resources among countries, among states, and among individuals has failed us. It was for some of these same reasons that we broke away from this concept long ago in agriculture and created private property rights as a means of allocating land, grazing rights, and water rights. For these same reasons, in my view, we are going to have to break out of this tradition in allocating fishery resources also. I am willing to speculate that until or unless we do this, commercial fishing will be inclined toward depression, and allocational disputes will actually increase in number and in severity.

Jurisdictional Split In Managing Fisheries

Another institutional constraint that hampers the optimum utilization and management of fisheries is the jurisdictional split in managing fisheries. How can we possibly regulate a fishery resource when part of it may lie within the 3-mile territorial waters of two or more states, part may be in the contiguous zone where no one, to date, has exercised full jurisdiction, and part may be located beyond 12 miles where many countries can fish it. To this day, states generally have no power outside their narrow territorial waters over fishermen landing in other states or in other countries, although recent action by Governor Sargent would seem to indicate that Massachusetts would like to change this. The Federal Government has chosen not to exercise power over domestic fishermen outside 3 miles unless these fishermen are fishing a resource under international agreement. International organizations or agreements for managing fisheries are slow and awkward in their operations. Very seldom is there a regulation bold or timely enough to be fully effective. Most regulations that finally come out of this obsolete maze of jurisdictional complexity are a compromise where political considerations often outweigh conservation, economic, and social considerations.

FUTURE OF LIVING MARINE RESOURCES

Now what does the future hold for our living marine resources? Although the National Marine Fisheries Service cannot solve all the problems discussed here, I want to tell you what is being done, within NMFS and on other fronts.

First, the foreign fishing situation. Until 1961, Georges Bank, one of the world's richest fishing grounds located just off our shores, was almost exclusively fished by U. S. vessels, although Canadian scallopers were taking increasing amounts of that ocean shellfish. The exploratory vessels of the Soviet Union first appeared early in 1961. The Soviet fleet grew, along with vessels from other European nations. At times there have been about 300 vessels from 7 or 8 nations fishing these grounds at the same time. Reports from our most recent surveillance flights indicate substantial numbers there today. In fact, it is not uncommon to see a fleet of over 100 large vessels from half a dozen nations concentrated within a 10-mile radius competing for sea herring.

ICNAF Established

Over two decades ago, the International Commission for the Northwest Atlantic Fisheries (ICNAF) was established to investigate, protect, and conserve the fisheries of the Northwest Atlantic Ocean. Fifteen nations, including the United States, are now members. Mesh regulations for cod and haddock went into effect under ICNAF in 1953. These contributed to the conservation of the stocks for several years during a stable fishery. The regulations failed in 1965, however, with the dramatic increase in fishing pressure. Many New England fishermen do not think ICNAF has served their interests very well, and some have suggested that the United States withdraw. Some of us think this would be a mistake, for ICNAF, with all its deficiencies, is the best tool we have at the present time.

Can ICNAF Do More?

What more can be done under ICNAF? International quotas have been established. This is a step in the right direction, even though it is too late.

A new protocol is now nearing adoption within ICNAF which, among other things, will allow for national quotas. Schemes for allocating catches to nations based on historical fishing patterns, coastal state needs, and allowing for developing fishing countries have been generally accepted by the member nations. This will be a big advance in international fisheries management.

However, these actions, under ICNAF, both implemented and proposed, do not satisfy the demands of U.S. fishermen and conservationists. This is understandable because international machinery moves slowly, and these new tools are coming after much damage has been done to the stocks.

Pressure For 200-Mile Jurisdiction

Many people interested in the oceans and the fisheries advocate unilateral action by the United States to declare extended jurisdiction

to 200 miles, to the edge of the continental shelf, or to the 100-fathom curve. Fishing interests in New England particularly are adamant that such action must be taken. There is considerable support for the position in some other parts of the nation, but the fishing industry has not always been unanimous in supporting this position. For example, some of our distant-water fleets fish off the shores of other nations. Their operators and fishermen believe extended jurisdiction by the United States would trigger retaliatory action and restrict their fishing.

1973 Law of Sea Conference

A third Law of the Sea Conference is scheduled for Geneva in 1973. NOAA is playing a very active role in preparing the U. S. Government position. Members of the fishing industry are being consulted. It appears that industry in various sections of the country is nearing agreement on a position that will be acceptable to all. Of course, fishing represents only one small part of broad discussions at Geneva on uses of the oceans. For example, the Department of Defense becomes deeply involved when a proposed broadening of the territorial sea might restrict the movements of the U.S. Navy or Air Force.

It is my opinion that our Government will not take any action in the foreseeable future to extend jurisdiction beyond the present 12-mile fishing zone.

What NMFS Is Doing

Through a major realignment of programs in NMFS, we are directing substantial new efforts towards the problems I have mentioned. Our Woods Hole Laboratory is accelerating ongoing efforts, including joint research cruises with the Soviet Union, to assure that adequate information will be available for our negotiators at the conference table when national allocations of fish stocks off our shores are decided. Furthermore, we nearly doubled our enforcement and surveillance activities in New England in 1971 to get a continuing record of the foreign effort and to be better able to enforce ICNAF regulations. The recently adopted International Inspection System under ICNAF is a fine new tool that allows our agents to board foreign vessels.

We have recently reprogrammed substantial amounts of money, which is augmented by new appropriations for our laboratories in Milford, Connecticut; Sandy Hook, New Jersey; and Oxford, Maryland. These new programs will be aimed at determining the effects of environmental deterioration and alteration on marine sport and commercial fishes. Work has been underway for some time in the New York Bight. It will be expanded initially into Long Island Sound and, ultimately, into other areas. Since some species, such as bluefish and striped bass, are migratory in nature and may be found from Cape Hatteras, N.C., to north of Cape Cod, Mass., our studies have broad applicability.

Concerning the result of institutional arrangements, we in NMFS are placing top priority on a new initiative to attack these root problems of our fisheries. We hope this will be a fully integrated and cooperative effort with the several states. We believe it is the responsibility of state and Federal governments and of leaders in industry and the academic community to address these problems.

The overall mission of this cooperative effort is to seek workable alternatives to some of these institutional constraints--particularly the common-property problem, and the split jurisdiction over fishery resources. Any solution of these deep-rooted domestic problems will require simultaneous action regarding stabilization of the international situation. It is our intention to move forward on both fronts so, when some national allocation of ocean resources is agreed upon, we shall be ready to manage our domestic fisheries, both recreational and commercial, most efficiently.

Efforts Will Bear Fruit

While the future of New England's living marine resources does not appear bright at the moment, we in NMFS are moving ahead aggressively in several directions. I am confident that these efforts and those of others will eventually bear fruit--and that Americans, whether commercial fishermen or sport fishermen, will be able to share in the bounty of the sea.

U.S. SHRIMP FLEET'S RECORD-SETTING CATCHES CONTINUE

In 1971 U.S. shrimp fishermen caught about 10 million pounds more than they had in 1970. It was their third consecutive record year. The 1971 preliminary figure was a little over 234 million pounds, heads-off weight.

Shrimp catches in the Gulf of Mexico and the South Atlantic accounted for 66% of the 1971 catch. These areas have produced large catches during the past 5 years.

The Alaskan shrimp catch has increased over 300% since 1966 and now represents about 25% of the total.

3 States Produced 70%

Three States--Alaska, Louisiana, and Texas--produced 70% of the total.

About 6% of the shrimp are taken off the Northeast, and 3% off Washington and Oregon.

Three species--white, pink, and brown--form the catch in the Gulf and South Atlantic; only a smaller, different species of pink shrimp is taken off Alaska, the Northeast, and Oregon and Washington. In the Gulf, shrimp are an annual crop. Off Alaska, the Northeast, and Washington and Oregon, they are not harvested until they are 3 to 5 years old.

In some areas shrimp are landed with their heads on. The figures given here have been converted to heads-off weight.

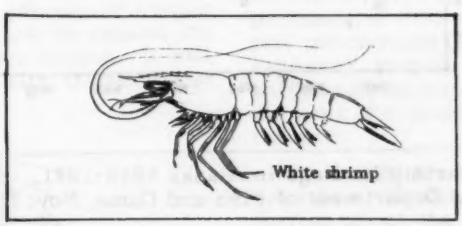
Most Valuable Species

NMFS Director Philip M. Roedel stated that shrimp are the most valuable commercial species--in 1971, worth $166.2 million to the fishermen.

"The increasing catch may be attributed primarily to an abundant resource, and to the growing number of vessels in the shrimp fishery, mostly in Alaska and in the Gulf of Mexico.

"However, it takes more than a plentiful resource and an aggressive fishing fleet to achieve the present status of the shrimp industry. Shrimp has long been one of our most popular seafoods, with more than a million pounds consumed every day in the United States. The processing and marketing segments of the industry have shown great imagination in providing consumers a wide variety of attractive products, including fresh, frozen, canned and breaded shrimp.

"All these factors contribute to the continuing strong market for shrimp and shrimp products."



White shrimp

ALASKA'S SHRIMP CATCH TOPS 100 MILLION POUNDS

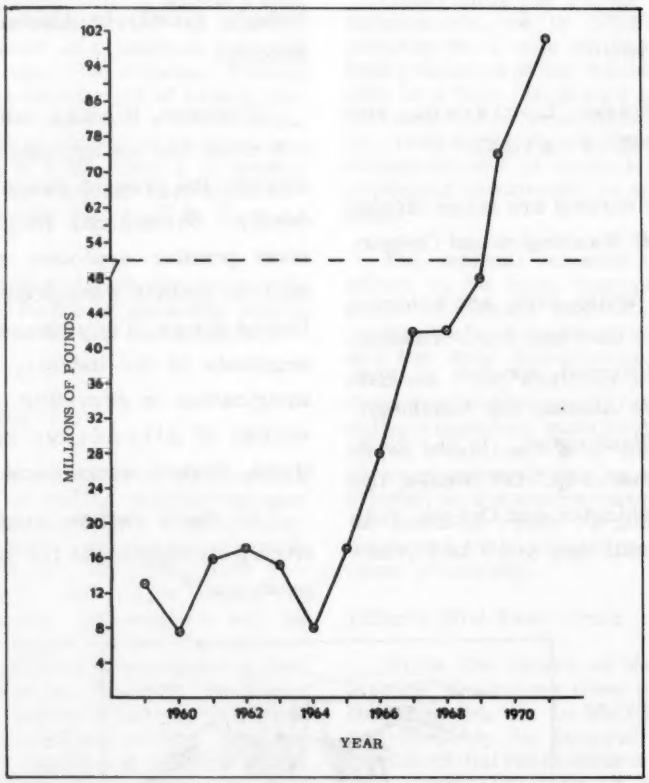
In 1971, Alaska's shrimp catch exceeded 100 million pounds. This climaxed a steady upward trend that started in 1964 (see figure).

Almost all the increase over the 1970 catch of 74 million pounds was due to the growth of the Kodiak Island pink-shrimp fishery. The number of shrimp processors in Kodiak increased from 4 in 1970 to 8 in 1971; the number of vessels from 20 to 40. The annual catch for some high-line vessels was close to 10 million pounds.

In April 1971, a 58-million pound annual quota was established in historic inshore shrimp-producing areas. This quota will not be met because most of the 1971 increase was from a nonquota area--the Marmot Bay region. The catch rate in this region through August 1971 was 4,459 pounds per hour.

Shrimp-Management Problem

Refined scientific methods for managing pandalid shrimp essentially do not exist in the circumpolar areas of the world where they are harvested. All pandalid shrimp change to females after spending the early part of their lives as males. This could lead to an unstable resource condition because the fishery operates almost exclusively on females, say NMFS Alaska Region personnel. "This condition may not be apparent, however, until it shows in depressed levels of future recruitment."



Annual shrimp landings in Alaska 1959-1971. Source: Alaska Department of Fish and Game, Nov. 1971.

ALASKA'S NO. 2 CATCH IS KODIAK SHRIMP

The shrimp fishery in the Kodiak Island, Alaska, area produced 80 million pounds in 1971, second only to salmon in Alaska's catch figures. The number of shrimp vessels rose from 16-18 in 1970 to 45-50 in 1971. Five new plants nearly doubled the processing industry's capacity.

In 1970, local fishermen recommended to Alaska's Department of Fish and Game that it establish a quarterly quota for shrimp catches in each major inshore fishing area. The Department did. It had 2 goals: to establish a basis for conservation, and to encourage exploration in new areas after inshore quotas were filled. Fishermen credit the quota system with providing the incentive that developed, in 1971, the new grounds in Marmot Gully, southeast of Kodiak Island.

Catch per unit of effort on established fishing grounds was somewhat less than in 1970; it was the highest on the new grounds. More than 20 million pounds of shrimp were taken from Marmot Gully in 1971. But as winter progressed, fishing became increasingly difficult in this exposed offshore area.

Concern About Stocks

Biologist are concerned that this catch already may exceed the maximum sustained yield for Kodiak stocks. They anticipate a rapid shift to new stocks. But where will new stocks be found? Results of joint research by NMFS, Alaska, and Soviet's 'Krill' in 1971 discouraged hope that significant new shrimp stocks will be found offshore, south of Kodiak Island on Albatross Bank. However, Soviet commercial efforts on Portlock Bank each spring in recent years suggest that offshore area beyond Marmot Gully may prove productive to those boats capable of fishing there. In 1972, NMFS plans to expand its research effort on northern shrimp. It will be coordinated carefully with industry and Alaska.

U.S. COOPERATES WITH USSR IN SURVEY OFF CALIFORNIA

On February 16, the 270-foot Soviet research vessel ALBA docked in San Pedro, Calif. It took aboard a U.S. scientist as an observer and its scientists discussed plans for the cooperative winter study of the distribution of hake spawning stocks off central and northern California. The vessel is operated by the Far Eastern Seas Fisheries Research Institute (TINRO) of Vladivostok. This was announced by Izadore Barrett, Acting Director of NOAA's National Marine Fisheries Service Southwest Fisheries Center in La Jolla, Calif.

The U.S. observer aboard the ALBA is James R. Trailkill, fishery biologist at the NMFS Southwest Fisheries Center. He is working with Soviet technicians to familiarize them with U.S. equipment and techniques for collecting samples and to assure standardization of sampling methods. The ALBA carries a crew of 72. Its scientific leader is Mikhail Stepanenko.

Continuing Research

Barrett said assignment of the ALBA to the 1972 research program was made at the annual meeting of U.S. and Soviet scientists in Seattle, Washington, November 1971. Both sides agreed on the necessity to continue studies on the life history, distribution, and abundance of the Pacific hake and Pacific ocean perch. These studies have been conducted cooperatively under the bilateral fisheries agreement since 1969.

ALBA's Role

The ALBA will conduct a fish egg and larva survey off Pt. Conception to the Oregon border for 15-18 days following tracklines supplied by the La Jolla Center. In addition to the ALBA, the NMFS research vessel, DAVID STARR JORDAN, the California Department of Fish and Game vessel, ALASKA, and the Scripps Institution of Oceanography research vessel, ALEXANDER AGASSIZ, will join in the cooperative survey, extending the area of exploration to south of Baja California.

In recent years, Barrett explained, hake have been fished by the Soviet fleet. Information about the resource is necessary to provide both nations with the scientific bases for agreements that will protect the fish.

NOAA WILL CHART ALASKAN WATERS & STUDY FISH RESOURCES

Twelve NOAA ships and an aerial photo plane will survey Alaskan waters this year, Howard W. Pollock, NOAA Deputy Administrator, announced on February 1. Purposes are to provide data for detailed up-to-date charts--and to conduct fish-resource studies for Alaska's increased marine activities and economic development.

NOAA's National Ocean Survey will operate 5 ships and the plane; NMFS will operate 7 ships.

New, large-scale, nautical charts of the narrow southeast Alaska waters are needed by all commercial and private vessels. The fishing, mining, forestry, and tourist industries have requested them.

NMFS Fish-Research Surveys

These NMFS vessels will conduct the fish-research surveys:

'Pribilof' will make 4 round trips between St. Paul in the Aleutians and her home port of Seattle, Wash., to transport supplies, return seal skins, and to carry high school students to and from winter classes.

'Oregon' will work out of Kodiak Island with special "separator" shrimp trawls around Shumagin Island in the Gulf of Alaska. These trawls are being developed to separate directly shrimp from small fish and other undesirable matter; now, the whole catch is brought aboard and separated by hand. Also, 'Oregon' will cruise to the Bering Sea to purse seine for salmon, test bottom trawls for crab and bottomfish, and take oceanographic observations.

'George B. Kelez' of Seattle will cruise south of Alaska Peninsula and to area of Aleutian Islands to assess salmon distribution. The information will be used to predict relative abundance of salmon and possible spawning-run strength.

'John N. Cobb' will work from Seattle into southern Alaskan waters to investigate groundfish abundance. This information will define further the relatively unused stocks of fish there.

'Miller Freeman' will be reactivated and may be able to conduct one survey of fish eggs and larvae in Alaskan waters during 1972.

'Murre II' will work out of Auke Bay, Alaska, and 'Cripple Creek' out of Kodiak Island in support of local biological and experimental fishing programs of their laboratories.

EXPERIMENTAL DRUM SEINING FOR WETFISH IN CALIFORNIA

F. J. Hester, D. A. Aasted, and R. E. Green

The authors consider the problem of operating a vessel profitably in a fishery for a fixed-price resource. They believe that more profit can be made by increasing the efficiency of vessel operation, thereby increasing landings, and by decreasing manpower through mechanization. In this study, purse-seining operations were mechanized by using a hydraulically powered drum to handle the net and a fish pump to load the fish. This increased operating efficiency by lessening time required to catch the fish--and by decreasing manpower required for the vessel operation. The experiments showed that the cost of mechanizing could be offset by recovery from the crew's share of the catch while increasing wages for the remaining crewmen.

THE PROBLEM

The San Pedro wetfish purse-seine fishery is the last major stronghold of the former California sardine fleet. Wetfish is a collective term for those species--anchovy, sardine, mackerel, and squid--used for canning and reduction that are bulk-loaded in the round, usually not refrigerated, and generally off-loaded with a suction pump. The vessels in this fishery are mainly ex-sardine seiners 45 to 90 feet long with carrying capacities of 25 to 150 short tons. About 24 of these vessels operate within a 100-mile radius from San Pedro, California. Perrin and Noetzel (1970) showed that this fishery was becoming increasingly unprofitable primarily because of rising costs of operations and demands for higher wages--while prices for the raw materials remained nearly constant. This situation is fairly common in countries where the standard of living is rising at a rapid rate and raw products prices, controlled by world markets, tend to rise at a lesser rate. The solution is to increase the productive efficiency of the operating units by increasing the production per unit of operating time and by decreasing the cost of operation. Such changes in efficiency can be realized in a number of ways, including increasing the size and speed of the vessels, changing fishing strategy, and mechanizing the operation to use manpower more efficiently. In the case of the San Pedro wetfish fleet, each of these approaches was considered.

The first was rejected for the time being because it was felt that the necessary capital for improved vessel design would not be forthcoming until the fishery's profitability was more apparent. The second could be a lengthy project, using operations research methods, and would require many logbook-type operating data over a long period. Such data are not now readily available (Petrich, 1965). It is the last of these three--mechanization--which will be reported here.

Cooperative Group Formed

In September 1969, a cooperative group known as the Wetfish Operation Pool was formed within the California Marine Research Committee. It comprises California's Department of Fish and Game, the Fishermen's Cooperative Association of San Pedro, the Fishermen's Unions, and the Operations

F. J. Hester is Director and D. A. Aasted is a Fishery Methods and Equipment Specialist, NMFS, Southwest Fisheries Center, Honolulu Laboratory, Honolulu, Hawaii 96812; R. E. Green is a Fishery Biologist, NMFS, Tiburon Fisheries Laboratory, Tiburon, California 94920.

COMMERCIAL FISHERIES REVIEW
Reprint No. 926

Research Group of the National Marine Fisheries Service, La Jolla, California. This pool, under a joint funding arrangement, chartered a San Pedro wetfish boat, 'Sunset', to experiment with mechanizing the fishing operation. The objective was to reduce by 40 to 50% the number of men required for working the vessel. Additional advantages sought were to decrease the time of the fishing operation, especially desirable for species available to the gear for only limited times during the day, and to develop a safer and less backbreaking method.

MECHANIZATION OF PURSE-SEINE OPERATIONS

A review of world purse-seining methods shows methods for handling the different phases of this fishing which, if combined, probably could achieve the desired results. These include a seine drum for reducing labor in handling the net, net modifications to permit easier handling of the catch, and pumping devices to load fish from net to vessel. It is hard to say what innovation has had the greatest effect upon purse seining but, quite likely, it would be one of the mechanical methods of handling the net.

Purse seining has developed from a completely mamual operation through an intermediate phase using powered roller to ease pulling the net--to, more recently, the introduction of side haulers, power blocks, or the net drum. The power block and the net drum originated at about the same time in the Pacific Northwest.

The power block, invented by Mario Puretic of San Pedro, California, revolutionized the handling of purse seines and has achieved worldwide recognition.

The drum seine, an invention of Nick Kelly from British Columbia (Philips, 1971), has not received the same acceptance for several reasons. The drum, because of its extremely rapid net-retrieving capability, was outlawed from the Alaskan salmon fishery as a conservation measure, whereas the Puretic block was legal and gained rapid acceptance. The drum was legal, however, in Canada and in the Washington salmon fishery, where it was accepted by boats that did not spend part of their time fishing in Alaskan waters. The power block has greater versatility with the type of net it can handle and is less costly to instal. However, vessels that used the drum have been very satisfied with its performance and recommend it over the block.

The drum appeared ideal for our needs with the San Pedro wetfish experiment. This was because the crew requirements were not dictated by the need for sufficient manpower to stand watches and repair gear on extended voyages. These vessels seldom are away from port for more than 24 hours. Second, the drum would reduce considerably the time in the set. It is a very important point because several principal wetfish species show near the surface only for a short time during day or night. The ability to make several sets in rapid succession may mean the difference between a partial or full load for the vessel.

Basically, the drum is a large reel powered either mechanically from the main engine or by a hydraulic motor. A purse seine is wound on the drum with the purse line left threaded through the purse rings. In addition to the drum, a mechanically or hydraulically driven level wind is used consisting of two upright rollers through which the net passes as it is retrieved.

In some vessels, the drum and level wind are installed on a rotating table so the net can be set over the stern and retrieved over the side. There are pros and cons to this innovation. Whether or not the benefits warrant the additional installation cost should be studied. We selected a drum installation consisting of a fixed drum with a level wind across the stern.

Fish Pump

The second major item of equipment gaining wide acceptance in purse seining is the fish pump. Several models are available. We chose for its ready availability the Marco[1] capsule pump. Fish pumps can load fish more rapidly than the conventional brailing net. Also, they require less manpower and eliminate the safety hazards of brailing.

[1] Use of trade names throughout this article does not imply endorsement by the National Marine Fisheries Service.

In addition to drum and pump, we incorporated into our experiment a hydraulically powered, reel-type pursing winch; a boom to handle corklines; and a "ring stripper" that automatically feeds the purse rings on to the drum during retrieval phase of operation.

DESCRIPTION OF SAN PEDRO INSTALLATION

The vessel made available to the Wetfish Operation Pool under a charter arrangement was M/V Sunset, a former California sardine seiner. It is of wooden construction with overall length of 90 feet, beam of 21 feet, and carrying capacity of approximately 150 tons. Sunset is powered by a 250-hp diesel producing a cruising speed of about 9 knots.

When delivered to us, she was rigged for wetfish seining with a power block driven by a small hydraulic pump running off the main engine. Other deck machinery included a mechanically driven double capstan winch for pursing and brailing. Because the existing hydraulic system was too small to handle the proposed additions to the machinery, the first modification was installation of an auxiliary engine and a 100-gallon per minute (gpm), 1800 psi hydraulic system. The auxiliary was a General Motors 160 hp. 6-71 diesel engine driving stacked 60- and 40-gpm hydraulic pumps off the power takeoff. In addition, a separate 30-gpm pump was mounted off the shaft. The 60-gpm pump was to drive the drum and fish pump; the 40-gpm pump was used for the winch, and the 30-gpm pump was used to operate the level wind.

The next modification was to attach a "beaver tail" (Fig. 1) to the shoe to protect rudder and propeller from the net. Beaver tails are commonly used in the Northwest

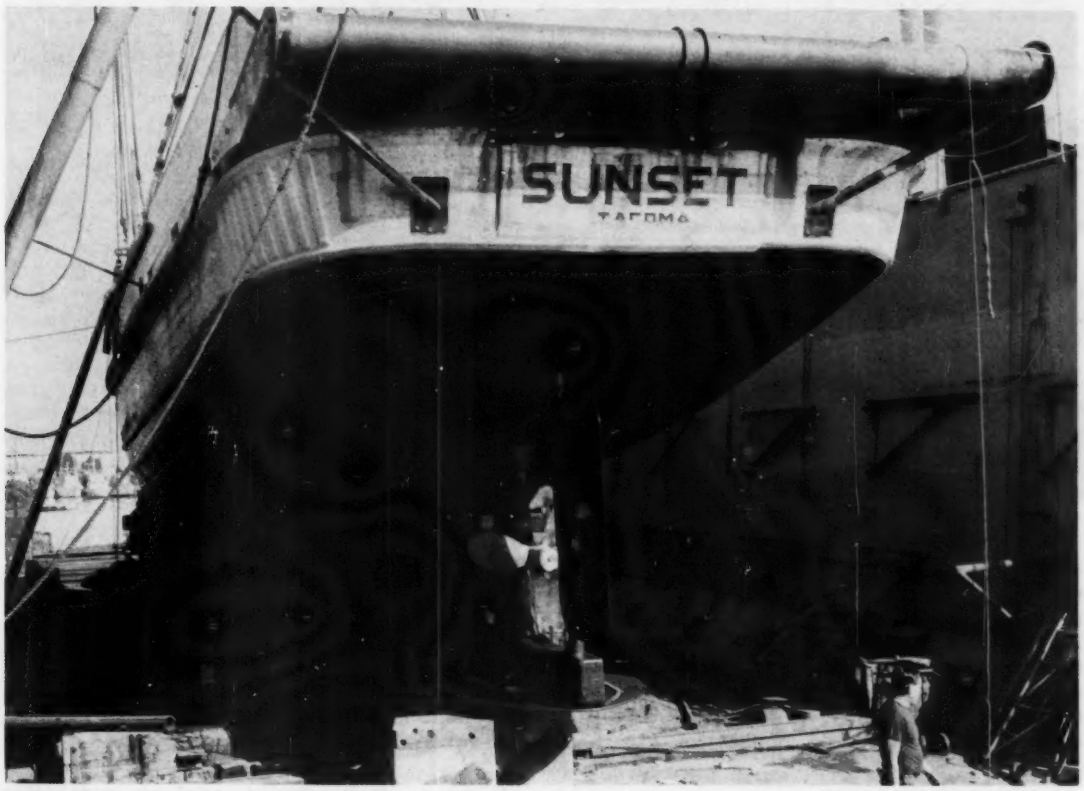


Fig. 1 - "Beaver tail" shown installed to bottom of shoe. Stern idling roller is also shown installed. (D. Aasted)

but have not found their way into our wetfish fleet. Because of the drum, the net passes over the counter and down the side of the vessel, and some protection is needed to keep the webbing from becoming tangled up in the propeller.

The third modification was to remove the turntable from the stern and to fabricate and instal in its stead the drum and level wind (Fig. 2). This unit was designed and built by Post Point Marine of Bellingham, Washington. The drum is aluminum with 8-foot diameter flanges and an 11-foot length core, 22 inches in diameter. The drum is driven by two Hydrostar hydraulic motors. The level wind consisted of two upright rollers mounted in a track across the stern. The level wind is driven by a chain and cable arrangement from a hydraulically powered sprocket. The controls for the drum and level line are mounted on the portside of the drum to allow operator a good view of the net. A complete hydraulic system diagram for Sunset is given in Figure 3.

The existing double capstan winch formerly used for pursing was removed and replaced by a hydraulically powered double drum dragging-seine winch. Because the tow line for the net is wrapped on the core of the drum, only two drums are needed for the pursing winch if the net is to be operated full-pursed; in practice, we operate the net half-pursed so that only one drum is used.

Fish Pump & Separator

The fish pump selected was a Marco U-235, 10-inch capsule pump. To handle it, we installed a 24-foot boom from which we also handled the corks of the fish bag. The wire basket-type fish-water separator was mounted on the starboard side adjacent to the opening to the fish hatch. This pump and separator had previously been tested aboard the vessels NEW ROMA, Monterey, California, and S. T. GUISSEPPI, San Pedro; it was satisfactory provided sufficient hydraulic capacity from the vessel was available.

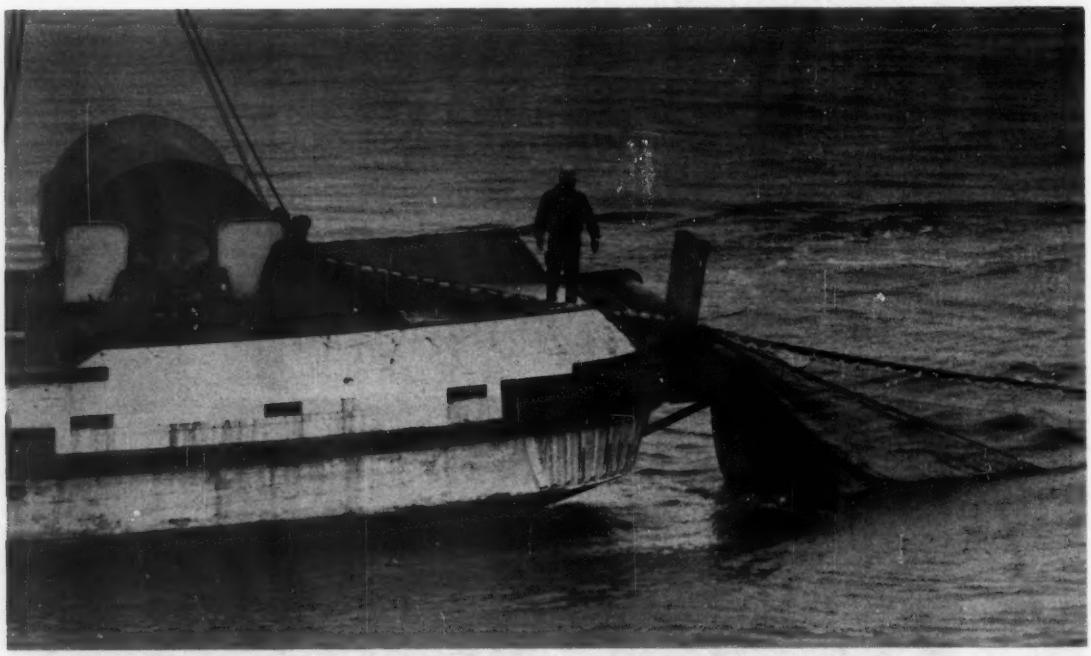


Fig. 2 - Drum and level wind on M/V Sunset. (R. Green)

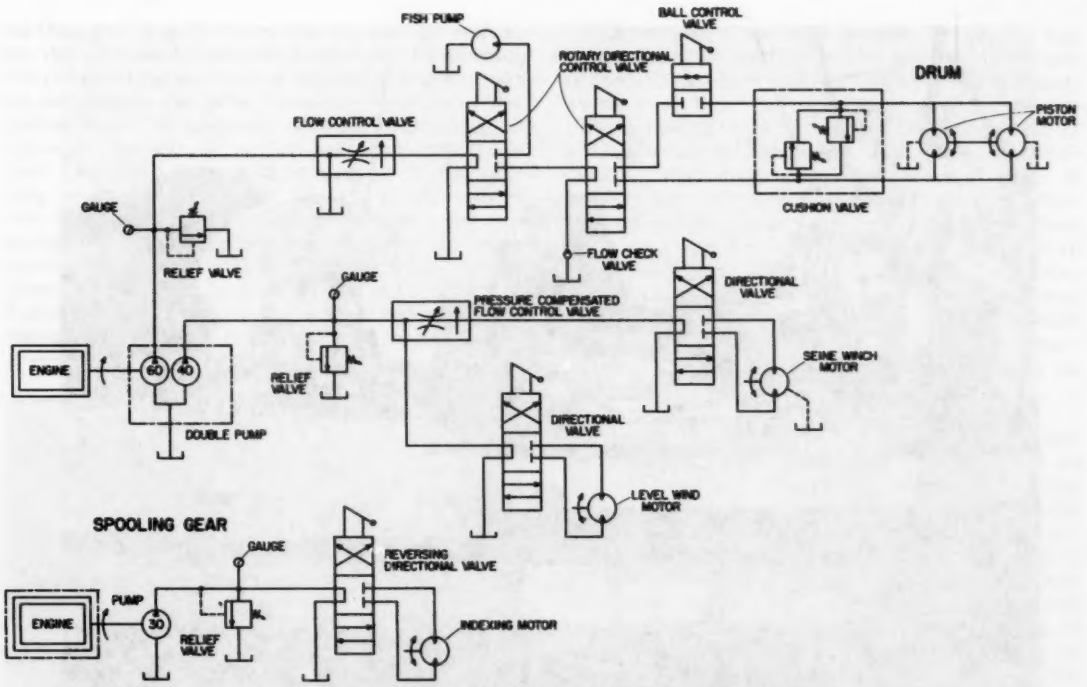


Fig. 3 - Diagram of hydraulics system installed on M/V Sunset.

A Whaley Engineering ring stripper was installed on the portside just aft of the pursing davit (Fig. 4). This ring stripper is described by Green, Perrin and Petrich (in press); it has replaced similar devices throughout the Northwest, including the "hairpin" in which the rings are suspended from the mast. When properly positioned, the ring stripper holds all purse rings during retrieval. It allows purse line to run freely through them while feeding off one ring at a time as net is retrieved.

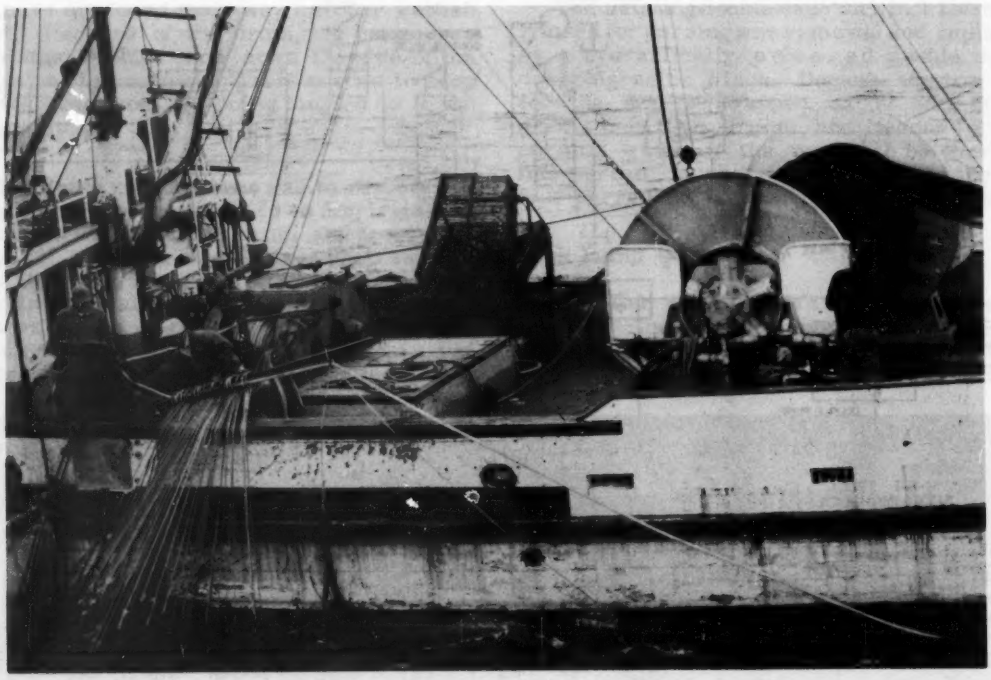
The Net

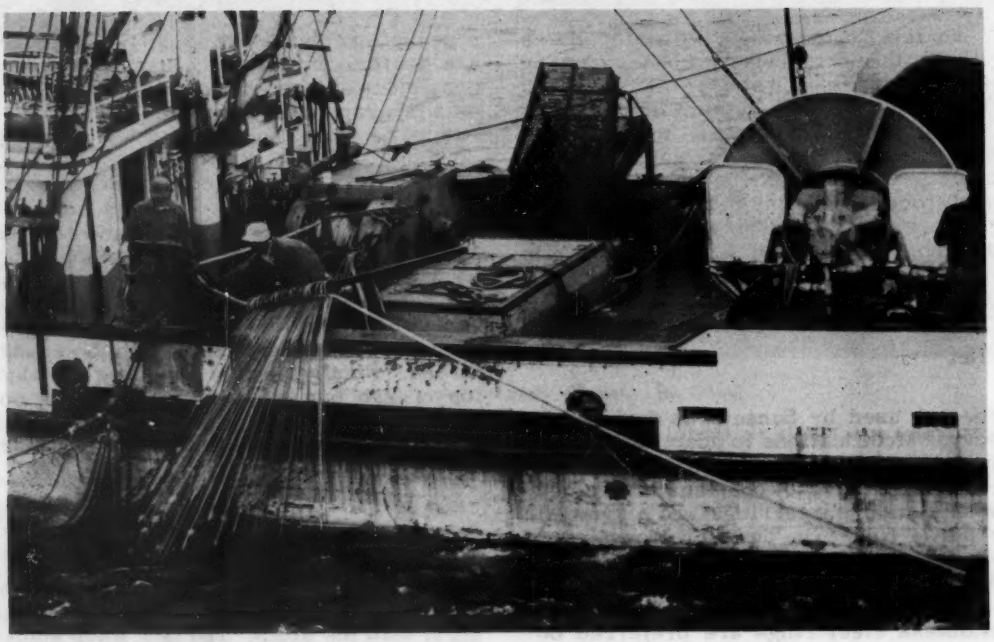
The net used by Sunset was designed for anchovy. Modifications to adapt it for drum seining involved replacing bridles with $\frac{1}{2}$-inch-diameter polydac rope, smaller diameter brass or stainless steel rings, and a synthetic rope purse line. The purse line consists of 50 fathoms of $1\frac{1}{4}$-inch-diameter braided nylon in area of main wear, followed by 150 fathoms of 1-inch diameter. The smaller brass or stainless steel rings are preferred because they are less abrasive to the synthetic rope than are iron purse rings. Rope bridles are preferred to chain because they reduce possibility of bridles becoming tangled in net as it is wrapped on the drum, and they do not rust. The chain leadline was left unchanged.

Because of the large compressive force on the part of the net near the core of the drum, it was necessary to remove the corks from that half of corkline and to mount them on a separate corkline to reduce breakage. We replaced the spongex corks with Sanyo, and later with Swedish floats, model 6215, which proved more resistant to the crushing forces. Finally, pucker rings were added to top of fish bag so floatline above bag could be gathered together and suspended from the boom; this obviated need for skiff to come alongside to support corks.

OPERATION

The initial problem of loading net on drum was attacked by stacking net on stern in usual fashion, setting it in a straight line, and reeling it onto the drum. The net, when stacked, presents an awesome pile which does not look





Figs. 4A & B - Ring stripper in operation. Ring on stripper in top photo (4A) has slipped in 4B. Purse line is feeding through rings. (R. Green)

as though it would fit on the drum. However, as the net winds on under tension, the volume is reduced by at least a third. When the net is set from the pile in a straight line, the purse line is allowed to run out, threaded through the rings so that both net and purse line can then be wound on drum. When setting from the drum (Fig. 5), a few fathoms of the bag are left free on deck and attached to seine skiff in usual fashion. Several seconds pass before inertia of the drum can be overcome and the net begins to pay out. The few fathoms of webbing in the water provides additional resistance that would not be available from skiff alone.

Fig. 5 - The start of a set. Skiff has been dropped and net drum is free wheeling. (R. Green)

When setting from the drum, the greatest hazard is the possibility of a backlash. It requires an alert operator to keep a slight tension on the drum at all times. Make sure that sticks and other stiff objects are not caught in the webbing where they could hold two layers of the net together on the drum. If these precautions are rigorously observed, chances of blacklash are very slight. However, because of this possibility, it is advisable to leave power skiff attached by its bow to the net until about a quarter of net is off the drum. Otherwise, if a backlash should occur while the skiff is turning and is broadside to the net, the skiff may be swamped. A tow line is wrapped on the core of the drum to allow setting in a larger circle than net will encompass.

Once tow line has been retrieved, the other end of purse line can be brought forward to the winch; or, if the net is partially pursed, as we have been doing, only one end of purse line is used for pursing, and the other end of net is wrapped on drum while pursing proceeds. With practice, the forward part of net will be pursed at same time that after part of net has been retrieved on drum. Then the rings are brought up and transferred to ring stripper. The balance of the net to the bag then is retrieved with the drum; the purse line is allowed to feed out from winch through rings on the ring stripper. The rings themselves pay out one at a time automatically as the webbing is retrieved (Fig. 4).

During pursing, the corks in bag are bunched and suspended from boom so that as bag is reached, the net is suspended by the last few rings on ring stripper with the corks hanging from boom. At this point, in the conventional manner, the net is passed forward of the drum and strapped in. When the fish are dried up, the pump is lowered into bag and the fish are pumped aboard. Once the bag is empty, the skiff comes alongside, takes the bag end and stretches it out in the water. The last few wraps of the drum are released to allow net to straighten out, and the bag is brought aboard on the drum.

The drum has other advantages: First, the set can be stopped at any point and retrieval begun. Second, because net is easy to handle, it can be let go in a straight line and retrieved to wash it; or, if repairs to the net are necessary, the vessel can hang from the net as on a sea anchor and repairs be effected.

FISHING TRIALS

Vessel modifications and equipment installation, with exception of new winch, were completed in May 1970. The first phase of field trials was a series of water hauls to uncover any unanticipated problems in performance and handling of gear. These trials were held near Los Angeles Harbor in calm water and were completed within a week. Then we proceeded with fish trials to evaluate further the effectiveness of equipment and to see if more improvements were possible.

At the outset, several minor problems were encountered, including difficulty in handling the rings when pursing from one

end of the net only. These problems were solved. At first, the existing double capstan pursing arrangement was not satisfactory. When it was necessary to "hold" the purse line on the capstan, the friction on the synthetic rope was sufficiently great to damage the purse rope. Also, it was inconvenient to tie off the purse rope during these momentary "holds". The best solution was to replace the capstan winch with a modified drum-type pursing winch. A hydraulic powered winch was installed, and the difficulties with purse line were resolved.

During the 1970-71 anchovy fishery, we obtained comparative time-in-set and manpower requirement data from other vessels in the San Pedro wetfish fleet. The combination of drum and fish pump resulted in significant decreases in time required to complete sets in nearly all catch-size categories (Table 1); often, it was possible to get an additional set in the brief time that fish were available just before dawn. We found one problem that did not occur on conventionally rigged boats. During retrieval, the net rubbed continuously against the vessel's counter and the chain leadline caused some scoring of vessel's hull. This was solved during next haul-out by installation of suitable rubbing strips on bottom and portside. Another possible solution would be to mount the drum on a rotating platform and to change location of level wind so net is retrieved off portside. This also would permit drum to be used to dry up fish completely. The modification should be studied.

Table 1 - Tons loaded per minute in set by size of catch

Size of catch (tons)	Tons/minute in set	
	SUNSET	Others in fleet
0-19	0.12	0.16
20-39	0.37	0.32
40-59	0.76	0.51
60-79	1.07	0.61
80-99	1.13	0.76
100 and over	1.18	0.98

Source: Unpublished logbook data furnished by the California Department of Fish and Game.

ECONOMICS

The purpose of the experiment was to evaluate the profitability of mechanizing small to medium purse seiners. The cost of the essential modifications to Sunset is given in Table 2. Labor performed by the vessel, crew, or National Marine Fisheries Service personnel during the installation is not included. Shipyard labor cost and contract labor costs are included since the costs cover specialized skills not readily available among average fishing crew. Table 3 illustrates possible recovery on this investment assuming investment is amortized over 5 years and financing costs run 15%. It is obvious that unless a larger share of catch is allocated to vessel, it is not profitable for owner to make this investment. However, with the illustrative distribution of vessel earnings given in the table, it can be seen that the investment can be recovered and

Table 2 - Cost of essential modifications for mechanizing M/V SUNSET

Drum, complete with level wind and stern roller	$17,000
Capsule fish pump and separator	3,500
Beaver tail	836
Modifications to net	680
Ring stripper	1,375
Dragger winch	6,039
Diesel auxiliary	2,500
Hydraulic system	4,571
Miscellaneous	1,759
Total	$38,260
Yearly cost $7,652 + (15% interest) 1,148 =	$ 8,800

Table 3. Economics of drum seining for anchovy (X1000). Annual vessel gross $138,000. Trip expenses $14,000[1]. Net proceeds $124,000

Share arrangement	Conventional seining with 10-man crew		Drum seining with 5-man crew					
	Boat 40%	Crew 60%	Boat 40%	Crew 60%	Boat 45%	Crew 55%	Boat 50%	Crew 50%
Share	49.6	74.4	49.6	74.4	55.8	68.2	62.0	62.0
Owner's costs[2]	32.2		32.2		32.2		32.2	
Drum and related costs			8.8		8.8		8.8	
Profit before taxes	17.4		8.6		14.8		21.0	
Crew share 1 man		7.4		14.9		13.6		12.4

[1]Means of 14 vessels, 1971 anchovy season.

[2]From Perrin and Noetzel (1970) increased by 40% coinciding with similar increases in annual vessel gross and trip expenses.

profitability of vessel increased. At same time, the average crewman share will increase greatly compared with his expected earnings on a conventional vessel.

During her first year of operation (1970-71) under this experiment, Sunset's earnings were compared with other boats of the fleet. Of 14 vessels that made bookkeeping records accessible, Sunset ranked seventh in gross income, fifth in boat share, and fourth in crew share. The average number of crewmen during this period was 5.4 on Sunset, and 9.9 on the other vessels. The share arrangement on Sunset was boat 50% and crew 50%. The mean share arrangement for the others was boat 40%, crew 60%.

Additional benefits that do not show in the fiscal data are the increased comfort and safety of crewmen with drum seining operation. It is no longer necessary for crew to stand in net pile with water dripping on them from above, nor to submit to the arduous and hazardous conditions of brailing. The use of ring stripper and dragger winch obviate most dangers associated with handling the rings. Since the rings never come aboard, but remain on side, the peril of working under the rings is removed. Further, the hydraulic dragger winch installation permits purse line to be handled without having loose coils of line on deck. The line can be stopped at any point during the operation. It is relieved automatically by hydraulic system if tension becomes too great.

CONCLUSIONS

1. The drum seining method of mechanizing purse seining operations is readily adaptable to the California wetfishery. The use of the drum speeds up the actual fishing time and decreases the number of men required to handle the gear.

2. Additional improvements that were tested and found to be of benefit are:

(a) The fish pump for brailing the fish into the vessel, which reduces the time and the manpower needed;

(b) the ring stripper, which simplifies handling the purse rings; and

(c) a hydraulic dragger type winch, which results in savings in manpower and a safer operation.

3. A vessel equipped with this equipment and operating with a reduced number of crewmen is capable of equalling or exceeding the performance of a power-block-equipped vessel.

4. The capital outlay for the drum seining modifications can be recovered by changing the vessel crew share arrangement of the vessel income.

5. The vessel crew earnings can be expected to increase with reduction in crew size. At the same time, they benefit from a reduction in the labor required during fishing and an improvement in safety.

LITERATURE CITED

GREEN, R. E., W. F. PERRIN, and B. P. PETRICH
In press. The American tuna purse seine fishery. Modern Fishing Gear of the World, 3:

PERRIN, W. F. and B. G. NOETZEL
1970. Economic study of the San Pedro wetfish boats. Fishery Industrial Research, 6(3): 105-138.

PETRICH, BORTI
1965. What I know about deep sea fishing. V. A. Sandoval Enterprises, Philippines. (Irregular pagination.)

PHILIPS, RICHARD H.
1971. The history of western seining. National Fisherman 52(5): IC-31C, September 1971.

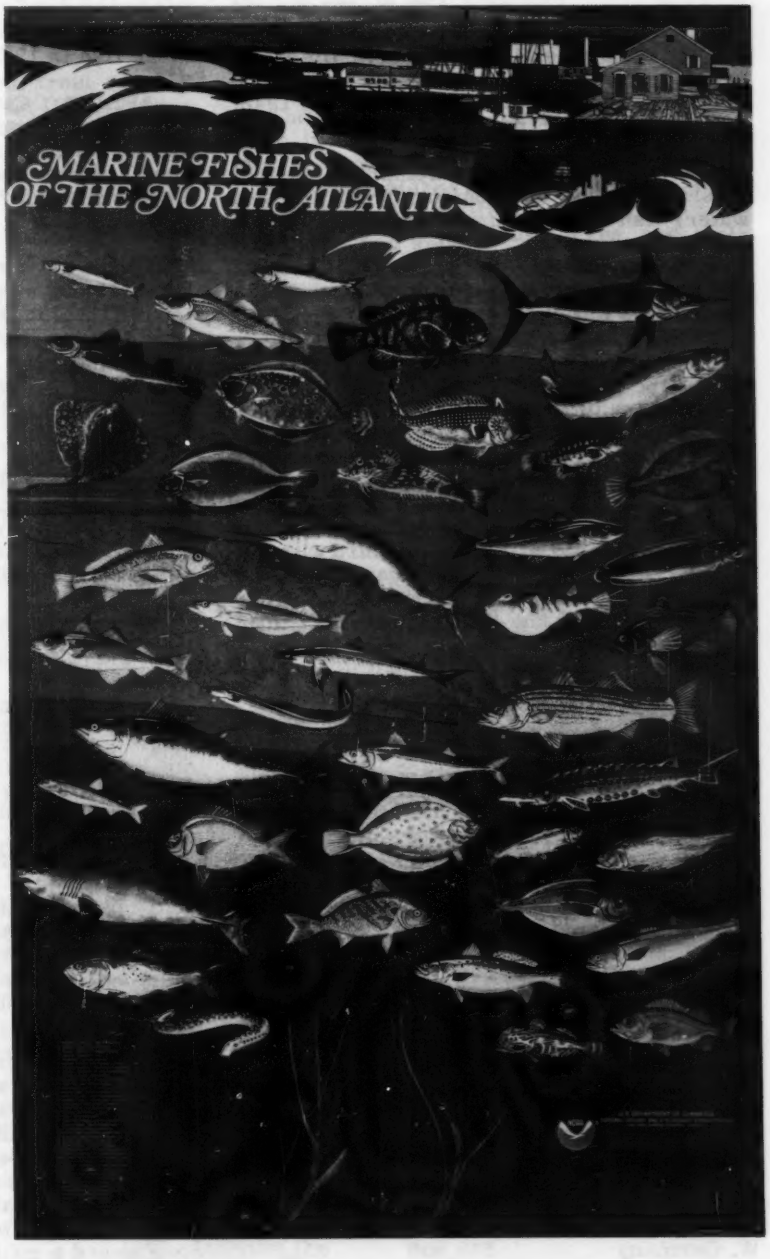
NMFS PREPARES NORTH ATLANTIC MARINE FISH CHART

NMFS has prepared a full-color chart showing 42 marine fishes of the North Atlantic from New England south to the Chesapeake Bay. It is the first in a series of 6 designed to meet a longstanding educational need. NMFS receives many requests from teachers and others for such material.

The other charts planned will show marine fish of the North Pacific, the Gulf and South Atlantic, the California-Hawaii area, and freshwater fish and shellfish.

The chart is 30 by 48 inches and can be framed for schools, libraries, restaurants, or recreation rooms. It is available for $1.50 each from the U.S. Superintendent of Documents, GPO, Washington, D.C. 20402.

The chart was developed by Bob E. Finley, Chief, NMFS National Marketing Service Office, Chicago, Illinois.



WORLD FISH CATCH ROSE 10% IN 1970

In 1970, the world fish catch rose more than 10% to a new record of 69.3 million metric tons. In 1969 it had dropped to 62.9 from 64.3 in 1968, the first decline in almost 25 years. This was reported by the UN's Food and Agriculture Organization (FAO). In 1948, the catch was 19.6 million tons.

The 69.3 million tons comprise marine, freshwater, and diadromous (fresh and salt water) fish and molluscs, crustaceans, and other marine life. Whales and seals are listed separately. The figure also contains a 5.8 million-ton estimate for China, which supplied no official figures.

THE STANDINGS

Peru remained No. 1 with 12.6 million tons (9.2 in 1969, 10.6 in 1968). Almost all of Peru's catch were anchoveta, processed into fish meal for export.

Japan followed with 9.3 million tons (8.6 in 1969). The Soviet Union was third with 7.3 million tons (6.5 in 1969); then China, 5.8 million tons (estimate); Norway, 3 million tons (2.5 in 1969); the United States, 2.7 million tons (2.5 in 1969); India, 1.7 million (1.6 in 1969).

Thailand was 8th with 1.6 million tons (1.3 million in 1969, 1.1 in 1968).

South Africa dropped to 9th with 1.5 million tons (1.8 in 1969, 2 in 1968).

OTHER NATIONS

	1970	1969
	(Metric Tons)	
Spain	1,496,600	1,496,000
Canada	1,377,500	1,504,800
Indonesia	1,249,000	1,214,400
Denmark	1,226,500	1,275,400
Chile	1,161,000	1,076,900
United Kingdom	1,099,000	1,083,000
Philippines	989,800	978,100
S. Korea	933,600	879,100
France	775,200	770,500
Iceland	733,800	689,500
Taiwan	613,000	560,900
W. Germany	612,900	651,600

CATCHES BY CONTINENTS

All the continents except Africa caught more fish in 1970 than in 1969.

AFRICA: Catch dropped to 4.2 million tons from 4.3 million tons in 1969 and 1968. This resulted mainly from catch decrease by South Africa, the largest fishing nation. Angola's catch fell from 419,200 to 368,400 tons.

Several countries increased catches: Chad from 110,000 tons to 120,000; Ghana, 162,800 tons to 187,100; Morocco, 227,200 to 256,000 tons; Nigeria, 115,700 to 155,800 tons; Senegal, 182,100 to 189,200 tons; Tanzania, 150,200 to 195,000 tons; Uganda, 125,300 to 129,000 tons; Zaire, 112,000 to 122,000 tons.

NORTH AND CENTRAL AMERICA: 4.8 million tons (4.5 in 1969, 4.6 in 1968). The U.S. and Canada accounted for most of it. The U.S. catch was its highest since 1964, but still below that of earlier years: in 1956, almost three million tons were caught.

Canada's catch was below 1968's and 1969's but above previous years'.

Cuba continued its steady catch rise: to 105,800 tons; in 1969, 79,700; 1968, 66,000 tons.

SOUTH AMERICA: The biggest increase of any continent. Catch rose to 14.8 million tons from 11.3 million tons in 1969. Peru produced most of the increase. Chile's catch also rose significantly--from 1.1 million to 1.2 million tons. Argentina's rose from 203,400 tons in 1969 to 214,800 tons. Brazil's remained level at 493,000 tons; Venezuela's dropped to 126,300 tons from 134,100 tons in 1969.

ASIA: Caught more fish than all the other continents and its highest ever--26.2 million tons; in 1969, 24.7 million tons. Japan was largely responsible. India, Thailand, and Indonesia followed, all in million-ton category. Thailand's catch increased significantly to almost 1.6 million tons from 1.3 million tons in 1969. The Philippines and S. Korea approached a million tons.

Gains were reported by S. Vietnam (577,400 tons), Burma (432,400 tons), Hong Kong (123,500 tons), and Yemen (115,000 tons).

Pakistan's catch dropped from 455,000 tons in 1969 to 420,000 tons in 1970; Malaysia's from 372,100 to 364,900 tons.

EUROPE (Excluding USSR): 12 million tons, up from 11.3 in 1969. Norway, Spain, Denmark, and the United Kingdom each exceeded a million tons. Following in order were France, Iceland, W. Germany, Poland, Portugal, Italy, E. Germany, the Netherlands, Sweden, and the Faroe Islands.

France's catch rose slightly to 775,200 from 770,500 tons in 1969. Italy had a record 403,400 tons (in 1969, 370,900 tons). W. Germany dipped slightly; E. Germany's catch increased from 309,900 to 321,800 tons. Iceland's reached 733,800 tons from 689,500 tons in 1969 and 600,600 tons in 1968, but it remained well below the 1966 peak of 1,240,300 tons.

Denmark's catch slipped from 1.3 million tons in 1969 to 1.2 million tons. Netherlands' catch fell from 323,200 to 300,700 tons.

OCEANIA: Australia, New Zealand, and South Western Pacific Islands. Harvested 190,00 tons, up 10,000. Australian catch was 102,600 tons; in 1969, 91,900 tons.

THE ECONOMIES

Developed countries increased their catches by slightly over one million tons to 26 million tons. Developing countries showed significant catch increases: from 23.6 million tons in 1969 to 28.1 million tons in 1970. This was due mainly to Peru; without Peru, the rise would have approximated the developed countries' rise.

The centrally planned economies expanded fishing from 14.3 million to 15.1 million tons. More than half of it was contributed by the USSR and Eastern Europe; China accounted for the bulk of the remainder.

CATCHES BY SPECIES AND AREAS

The greatest catch increases during 1970 were in marine fishes: from 48.3 million metric tons in 1969 to 53.5 million tons. Freshwater catches increased slightly--from 6.8 million to 7 million tons. There were small increases in crustaceans and molluscs.

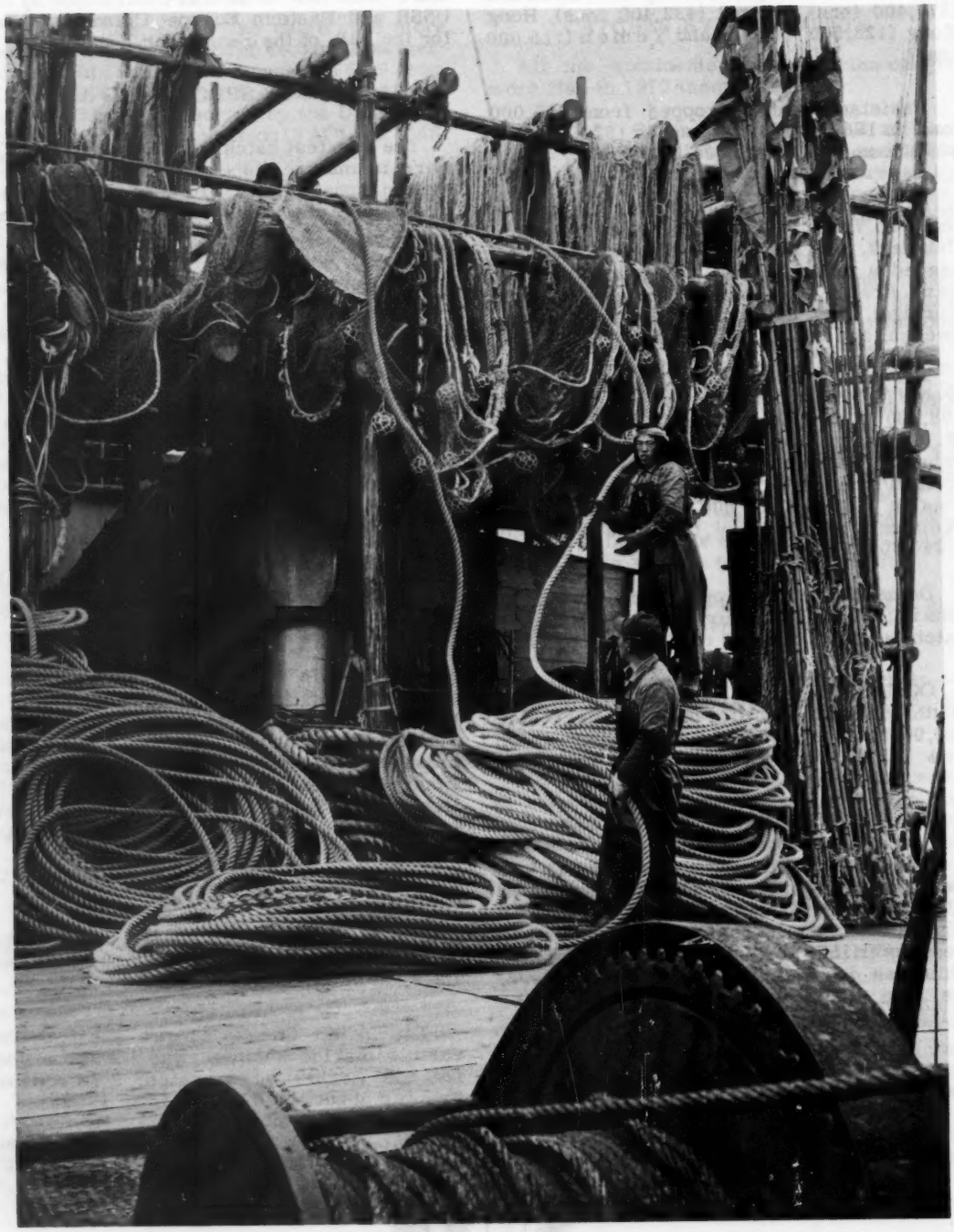
Herrings, sardines, anchovies and related species were bulk of the marine catch: 21.2 million metric tons. South African pilchards dropped significantly, from 1.4 million to 700,000 tons. Alaskan pollack, cods, hakes, haddocks, redfishes, and mackerels were higher. Tuna catches remained at about 1969 level. Shrimps rose. Carps increased considerably among the freshwater fishes, from 166,000 to 193,000 tons.

Whale catches rose from 41,735 to 42,266, mostly sperm whales, but figure was lower than in most earlier years.

The Pacific Ocean produced the largest catch: 35.3 million tons, compared to 30.1 million tons in 1969. The Atlantic Ocean yielded 23.6 million tons, up one million. Most Atlantic catches were in Northeast and Northwest Atlantic, which yielded 14.8 million tons. In Southeast Atlantic, where a new international fishery convention became operative recently, catches dropped from 3 million tons in 1969 to 2.4 million tons in 1970.

The Mediterranean and Black Seas, grouped within the Atlantic region, produced 1.1 million tons; in 1969, 970,000 tons.

The Indian Ocean, about one-fifth the earth's marine surface, was a small arena for the world marine catch: 2.7 million tons, up about 160,000 tons from 1969.



Stowing net and line aboard the 'Shinyo Maru'.

THE JAPANESE FISHING INDUSTRY: 1971 HIGHLIGHTS

William B. Folsom

The year 1971 should be another successful one for the Japanese fishing industry. As in previous years, the Japanese were extremely active--searching for new grounds, developing new techniques and products, and establishing new overseas joint ventures. Indications were that a new catch record was set, imports of marine products appeared to reach a new high, but canned-tuna exports declined sharply.

CATCH: Figures for Japan's 1971 catch are not yet available, but it would not be surprising if these exceeded its record 1970 catch of 9,272,000 metric tons (Fig. 1) worth US$3 billion. The marine catch is expected to comprise over 90% of this total, finfish nearly 80% of the marine catch, molluscs 7%, shellfish 6%, seaweeds 5%, and other species 2%.

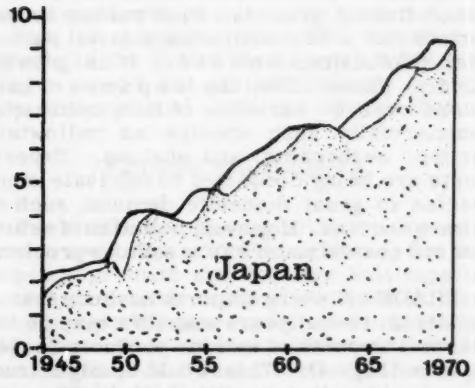


Fig 1 - Japan's fisheries catch, 1945-1970 (in million metric tons).

CONSUMPTION: The 1968 record annual per-capita consumption rate of 71.3 pounds of fishery products decreased to 67.5 pounds in 1969. Information for 1970 is not available, so a projection for 1971 can not be made. However, consumption of higher quality and more expensive fishery products (like shrimp) rose again in 1971. Total consumption of edible fishery products was expected to exceed 6 million metric tons.

With the Japanese eating more high-quality fishery products and paying more for them, the consumer price index for fresh fish and shellfish was expected to increase. During 1965-1969, the index rose 46.4%.

FISHERY COMPANIES: During the past few years, the number of smaller fishing companies has decreased; larger firms, such as Taiyo, Nichiro, Nippon Suisan, and Kyokuyo Hogei, have increased in influence, sophistication, and in development of new technology. This trend was expected to continue in 1971. The major companies appear to have had a profitable year. Taiyo has reported after-tax profits of roughly $5.5 million and declared a 6% dividend following a 2-year "recession" beginning in 1968. However, those firms dependent upon canned-tuna exports to the United States suffered reversals in 1971.

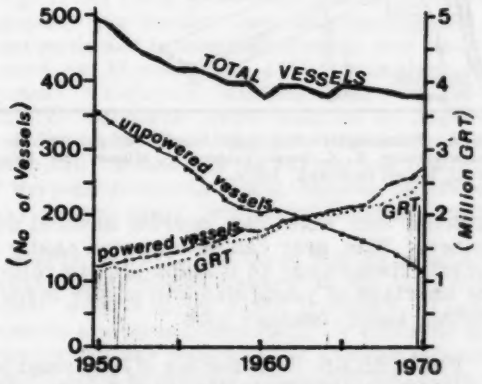


Fig. 2 - Size and number of Japanese fishing vessels, 1950-1970.

Mr. Folsom is on International Activities Staff of NMFS.

COMMERCIAL FISHERIES REVIEW
Reprint No. 927

FLEET: In the past 20 years, the fishing fleet has decreased steadily in numbers while increasing in tonnage (Fig. 2). It is believed this trend continued in 1971. In 1970, registered fishing vessels numbered 391,789 totaling 2,531,317 gross tons; unpowered fishing vessels totaled 120,600 vessels, powered vessels slightly over 271,000 vessels. One of the most significant events in 1971 was the launching of 5 giant 5,000-GRT stern trawlers for fishing off Alaska.

GEAR: To offset the high cost and shortage of labor, the industry continually seeks to improve operating efficiency, experiments with new techniques and fishing gear. One interesting development in 1971 was deployment of the "robot" automatic skipjack fishing machine (Fig. 3) that proved highly successful during sea trials. Skipjack pole-and-line fishing requires many men. The robot substantially reduces manpower requirements

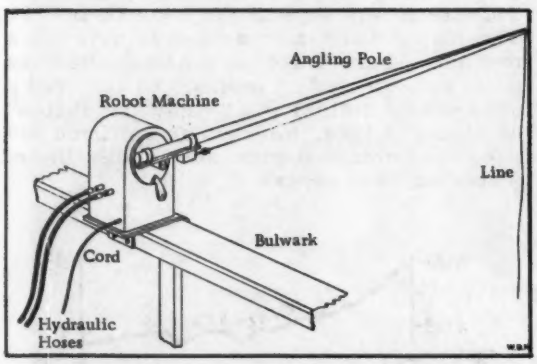


Fig. 3 - Robot skipjack tuna angler based on the drawing by the manufacturers, K. K. Suzuki Tekkojo, 7, Mikawa-cho, Ashinomaki, Miyagi Prefecture, Japan.

because one man can operate several machines. This gear can be operated easily by elderly fishermen, so it helps also to relieve the shortage of young men who prefer higher-paying, safer, onshore jobs.

FISHERMEN: The number of fishermen has declined about 20% in the past decade and a further drop was expected in 1971--to about 500,000. Wages and working conditions on the fishing vessels have improved, but the industry is still having difficulty attracting and retaining able young men.

FISHERY AGENCY: A new Fishery Agency Director, Y. Ota, was appointed in June 1971. He indicated that he planned to emphasize the development of deep-sea fishery resources. In late 1971, the Fishery Agency (JFA) announced it would add 3 new divisions (fish culture, fisheries engineering, and fisheries environment) to its 8 regional fisheries research laboratories. The JFA's FY 1971 budget (April 1971-March 1972) was a record US$139 million. Most of this money was earmarked for port construction and insurance; funding for deep-sea marine science was increased by 53% over FY 1970, to $3.4 million.

RESEARCH: As in previous years, marine research enjoyed high priority. Two new institutions, the Marine Science and Technology Center, and the Marine Fishery Resource Development Center, were formed to promote the development of marine sciences.

TYPES OF FISHERIES: Marine fisheries continued to play a major role. High-seas fishing becomes increasingly important as the spread of pollution threatens coastal and inland fishing grounds. Fish culture is important but still constitutes a small part of total production; however, it is growing rapidly. Since 1950, the Japanese have raised over 50 varieties of fish, cultivating commercially such species as yellowtail, shrimp, seabreams, and abalone. Experiments are being conducted to cultivate other species in great domestic demand, such as salmon and tuna. However, pollution of estuarine and coastal waters is a serious problem.

TRADE: Fishery imports have increased rapidly in recent years and 1971 may be the year that imports of marine products exceed exports (Fig. 4). This would be significant for a nation that traditionally has been a leading exporter. As of October 1971, imports were 53% over same period of 1970.

In 1970, Japan imported 374,569 metric tons of marine products worth US$318 million. In value, shrimp accounted for 43%, followed by tuna, 8%. Other important imports were squid, fishmeal, salmon roe, and octopus. Leading suppliers in 1970 included South Korea, China, the United States, Taiwan, and Mexico.

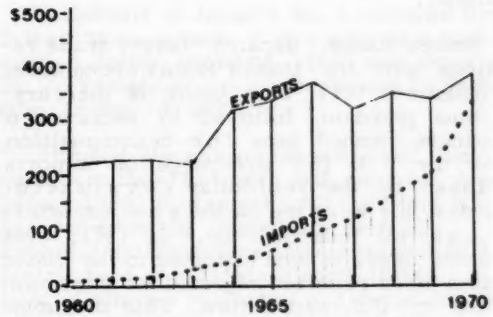


Fig. 4 - Japan's Fishery Trade, 1969-1970 (in US$1 million).

In 1970, fishery exports were valued at US$391 million. Its largest customer was the United States ($128 million, a record), followed by the United Kingdom ($46 million), West Germany ($25 million), Italy ($16 million), and the Philippines ($16 million). Principal export items were canned tuna, canned mackerel, pearls, canned salmon, and frozen tuna exports, In 1970, canned tuna exports to the United States totaled $42 million, a record, but declined sharply in 1971. (See International Affairs; United States.)

FISHING HIGHLIGHTS

Pacific Ocean: During 1971, the Japanese were especially active in exploring for new skipjack grounds and for live bait supplies in the southwestern Pacific. Joint skipjack fishing ventures were established in Indonesia and Papua-New Guinea. Efforts to do the same in the U.S. Trust Territories were not successful. In October, a voluntary ban on fishing southern bluefin tuna was adopted by Japanese tuna fishermen.

The Japanese continued their intensive trawl fisheries on the U.S. Continental Shelf in the eastern Bering Sea. Their 1971 pollock catch was expected to exceed easily 1970's catch of 1.2 million metric tons, about 85% of their total catch in that area. They met their 1971 quota of 37,500 cases (48½-lbs.) of king crab and 14 million (plus 10% allowance) of tanner crabs. Their catch of king and tanner crabs in the eastern Bering Sea is regulated by the Dec. 1970 agreement with the United States. The Japanese also initiated a new fishery for sea snail in the eastern Bering Sea.

Off the Pacific Northwest and northern California, they continued their saury fishery. In 1971, 49 vessels were reported licensed to fish off the U.S., but only 18 were sighted by U.S. surveillance officers during the peak of this fishery. Catches were reported poor: 1,300 metric tons compared to 3,278 tons in 1970.

In late 1971, the research vessel 'Ryoun Maru' scouted for squid off Cape San Lucas, south of Baja California. Initial reports indicated it was doing well, but later reports were not satisfactory.

Tuna fishing in the southeastern Pacific was marked by the arrival of the 'Nippon Maru', a 999-GRT purse-seiner, built to U.S. specification. U.S. fishermen were hired to train the crew on the vessel. If trial runs prove successful, the Japanese may build more.

Atlantic Ocean: The 'Nippon Maru' also fished off west Africa, where the Japanese operate 50-80 tuna vessels. The Japanese also extended their fishing agreement with Mauritania, where they now operate a joint fishing venture. The Japanese have a very large trawl fishery off Mauritania for squid, octopus, sea-bream, and jack mackerel. A joint squid and bottomfish fishery was established in Morocco in 1971, with plans for another venture (shrimp) there in 1972; similar ventures were planned in Nigeria and Senegal. The Japanese are anxious to establish themselves in Africa now because of the possibility that some African countries may extend their territorial/fishing limits.

Early in 1971, one large fishing company began a year-round fishery off the U.S. East Coast with 5 large stern trawlers. These vessels are joined seasonally by other larger trawlers, some based in the Canary Islands. They fished primarily for argentine, butterfish, and squid (estimated 1970 catch was 36,627 tons) but intensified their effort for herring (1970 catch 1,125 tons). There is a world supply shortage of herring. Japanese tuna longliners appeared in autumn 1971 off Cape Cod, Mass., in search of bluefin tuna. These tuna are highly prized as "sashimi" (thinly sliced raw fish). Some of these vessels reportedly purchased tuna from U.S.

fishermen. About 5 shipments (3-6 fish per shipment) of bluefin caught by U.S. fishermen were shipped by air to Japan, where they sold for $3.19/lb.

The end of 1971 was marked by reports of damage to U.S. lobster gear caught by some Japanese trawlers operating off U.S. Atlantic coast. Japanese longliners again were reported in Gulf of Mexico fishing for yellowfin tuna.

Indian Ocean: The Japanese have a sizable tuna fishery and processing/transshipment bases in or bordering the Indian Ocean. There were no significant developments in 1971.

Antarctic: The catch of baleen whales in the Antarctic is regulated by the International Whaling Commission. Japan's 1971/72 baleen whale quota is fin whale, 1,566, and sei, 3,378, equivalent to 1,346 blue whale units. The Japanese also planned to take 1,000 sperm whales and 3,000 minke whales by February 1972. They are concentrating especially on minke whales this year because this species is still relatively plentiful and not subject to quotas.

INTERNATIONAL AFFAIRS

The Japanese industry is somewhat concerned over possible extension of territorial/fishery jurisdictions by some coastal states, principally in Africa. This prompted them to try to establish themselves in some of these countries before the extensions were made. Japanese coastal fishermen pressured their government to extend Japan's 3-mile territorial sea to 12 miles to protect their offshore resources from foreign fleets, mainly Soviet.

A major development in 1971 was the Japanese decision to let the yen float following the U.S. imposition of a 10% surcharge on imports. Japanese fishery products thereby became more costly, while non-Japanese goods became cheaper. The uncertainty over exchange rates caused some confusion initially.

United States: Japan's fishery trade relations with the United States encountered problems in 1971. First came the mercury-in-tuna problem, followed by seizures of Japanese canned tuna for decomposition, then the U.S. 10% surcharge on imports, followed by the yen/dollar revaluation. Hardest hit were the packers and exporters of canned tuna-in-brine. In 1971, over 400,000 cases of tuna exported to the United States were reported rejected for decomposition by U.S. authorities. This disrupted Japan's canned-tuna trade; exports were suspended during the latter half of 1971. Large stockpiles accumulated in Japan. In December, a government/industry team was sent to the United States to discuss the tuna decomposition problem.

Soviet Union: The annual Japan/USSR fishery negotiations went badly for the Japanese in 1971. Catch quotas for salmon, crab, and herring were reduced and the fishing season delayed. The Soviets imposed a ban on herring fishing in the Okhotsk Sea, preventing Japanese access. This created difficult internal problems for Japan. Soviet seizures of Japanese vessels for illegal fishing off the USSR continued. In late 1971, large numbers of Soviet vessels (50-100 vessels) began fishing for mackerel off Japan's northern Pacific coast, further irritating Japanese fishermen.

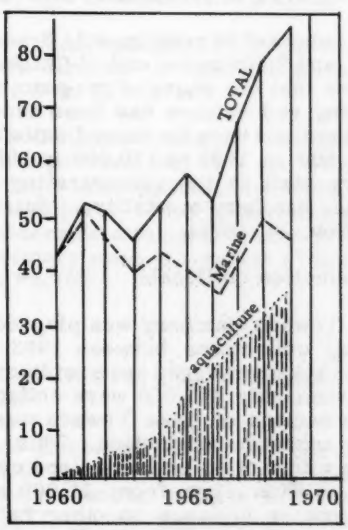
China: Japanese trade in marine products with China increased to $31 million 1970 and was expected to continue to expand in 1971. Shrimp was the single most important import ($19 million in 1970); it was anticipated that herring might become another important commodity in 1971-72. If Japan recognizes China, the private fishery agreement concluded between Japanese fishery firms and China may be changed into an official agreement later.

JAPAN

YELLOWTAIL IS NO. 1 CULTURED FISH

Yellowtail is Japan's No. 1 cultured fish. In less than a decade, it has become a multi-million dollar industry. This was reported by T. Yamamoto to a symposium in Paris, Nov. 29-Dec. 3, 1971.

Although the culture of yellowtail (Seriola quinqueradiata) had been underway for years before 1960, it was not until then that it began to grow in importance (see Fig.). By 1969, 4.3 million fingerlings produced 36,725 metric tons of yellowtail worth US$44.7 million. Cultured yellowtail accounted for 42% of yellowtail production (87,850 tons).



Yellowtail catch (1,000 metric tons).

Grows Fast

Yellowtail, "buri" in Japanese, is one of the world's fastest-growing fish. In 100-120 days, it will grow from 2 cm ($\frac{3}{4}$ inch) to over 40 cm (1'4"); it will weigh nearly 1 kilogram (2.2 lbs).

Fortunately for the culturist, the consumer prefers yellowtail 12 to 18 inches long. This allows him to grow fish when weather is warm and growth at maximum. Usually, the fish are shipped live to nearby markets; the nerve (pith) is severed just before shipment so fish remain alive but dormant. Generally, the fish are eaten raw.

Culture

Yellowtail larvae are normally caught in the early spring drifting under seaweed off Pacific coasts of Kyushu and Shikoku Islands. Then they are raised in "embanked ponds" (563,000 sq. meters in 1969), net-enclosed ponds (1,942,000 sq. meters), or in floating, net-cages (751,000 sq. meters). The fry are fed a mixture of artificial formula foods or frozen scrap fish. They seem to thrive on sand lances, anchovy, and jack mackerel. Currently, the cost of feed accounts for 60% of the total investment in cultivation. The Japanese are trying to cut these costs.

* * *

SKIPJACK FISHERY'S LIVE-BAIT PROBLEM

In 1971, the major Japanese skipjack fishery firms advanced into western equatorial Pacific to develop grounds. As 1972 began, they were preparing to move from exploration to full-scale operations.

Taiyo Gyogyo has established a base in the Solomon Islands; Nichiro at Ternate, Helmahera (Indonesia); Hoko Suisan at Kendari, Celebes; Kaigai Gyogyo, Kyokuyo, and Hokoku Suisan at Papua, New Guinea; and Sanyo Gyogyo of Okinawa at Ponape (U.S. Trust Territory). Fishing is still experimental, but progress likely will be made in 1972 to form joint ventures with local interests.

The available Pacific skipjack resource is estimated at around 800,000 to 1 million tons. The Japanese annually take about 250,000 tons, so it is possible to increase the catch. More investigation is necessary. Skipjack distribution in the Indian and Atlantic oceans is estimated at 200,000-400,000 tons each.

Live-Bait Problem

To harvest skipjack, it is necessary to solve live-bait problem. The domestic live-bait supply is mostly anchovy. Sardine, small

JAPAN (Contd.):

mackerel, and sand lance also are used to some extent. After hauling, anchovy cannot be transported immediately to fishing grounds. They must be held in receivers for at least one week. Transporting the fish from baiting ground to receiving point is a problem. So too is the heavy die-off--from 50 to 70% of catch.

In 1971, the Federation of Japan Tuna Fishery Cooperative Associations (NIKKATSUREN) transported successfully (presumably to fishing ground) the first supply of anchovy purchased from South Korea. NIKKATSUREN hopes to set up a bait-supply point at Nagasaki and plans to build a net enclosure there. It is investigating availability of baitfish in Taiwan. Bait procurement remains the bottleneck for overseas-based operations. ('Katsuo-maguro Tsushin', Jan. 3, 1972.)

* * *

HERRING FISHING IN EASTERN BERING SEA

In early January 1972, 23 Japanese stern trawlers were active in the winter herring fishery of the eastern Bering Sea north of the Pribilof Islands. Also, close to 80 Soviet trawlers were fishing there.

Japanese production from about Nov. 22, 1971, when the winter operation started, until Jan. 5, 1972, totaled approximately 15,000 metric tons of frozen product; of these, about 5,000 tons were shipped to Japan in late 1971. Compared with previous years, the herring are large but the eggs are not as good; the fish run is smaller. ('Suisan Tsushin', Jan. 6, 1972.

* * *

RED-SALMON CULTURE INCREASED TO OFFSET DWINDLING CATCHES

To offset their dwindling catch of red salmon, the Japanese have turned to the artificial propagation of native, land-locked red salmon, the "kokanee", and Alaskan red salmon.

Hokkaido Program

The Nijibetsu Hatchery on Nishibetsu River, Hokkaido Island, is an important center in Kokanee culture. It began experimenting in 1960 but money problems stopped operations. Kokanee had been raised and released during this trial period. Then fortune helped: 20 fish returned in 1965 to their breeding grounds. This excited fishermen.

In 1967, the Nijibetsu Hatchery again began rearing kokanee, more successfully this time. In 1968, red-salmon eggs from Bear Lake in Alaska were imported and hatched together with kokanee eggs; the young were released in the Nishibetsu River. ('Fishing News International', June 1970.)

The return of 56 reds (mostly 3-year olds) in 1970, and 2,609 by the end of October 1971, indicates that one phase of program to raise sea-going red salmon has been successful. Egg collections have increased satisfactorily from 4,500 in 1967 to 170,000 in 1970. The hatchery staff is now concentrating on ways to reduce hatchery mortality. ('Suisan Tsushin', Nov. 19, 1971).

Egg Collection on Honshu

The Towada Hatchery was plagued by decreasing collections between 1963, when 5 million kokanee eggs were collected, and 1970, when only 800,000 were collected. In 1971, a section of Lake Towada was closed to help increase production. This closure and the effort of scientists raised collection to 2.1 million eggs from 11,000 reds. It ended former reliance on other hatcheries for eggs. ('Suisan Keizai', Nov. 23, 1971.)

Commercial Salmon Culture

Nichiro Gyogyo, one of Japan's largest fishing firms, recently bought a large tract in northern Hokkaido to rear red salmon artificially. The company is seeking supplies of red salmon eggs. It plans to expand from freshwater to saltwater culture. If it successfully rears red salmon in salt water, it should be able to supplement its decreasing share of North Pacific red salmon catch within a few years. (U.S. Embassy, Tokyo.)

* * *

JAPAN (Contd.):

NEW GROUP COORDINATES SKIPJACK FISHERY

The 6 Japanese firms that have been conducting exploratory skipjack fishing in the tropical waters of the southwestern Pacific have formed a group to coordinate arrangements for (1) procuring bait, (2) scouting for fish, (3) buying skipjack from local fishermen, (4) resolving problems within joint ventures, and (5) training fishermen.

The 6 firms are Taiyo Gyogyo near the Solomon Islands, Nichiro and Hoko Suisan in Indonesia, and Kyokuyo, Hokoku Suisan, and Kaigai Gyogyo in Bismark Sea area.

Tetsuo Ueda, executive director of Hokoku Suisan, is director of new group. ('Suisan Tsushin', Dec. 23, 1971.)

NMFS Comment: These companies are strong competitors, but they are willing apparently to work together to develop a fishery for skipjack. This resource is attracting considerable attention in tuna fisheries. Their primary area of interest is the southwestern Pacific.

* * *

SQUID CATCH OFF U.S. WEST COAST WAS LOW

In late December 1971, the 'Ryoun Maru No. 3' (300 gross tons), surveying squid in the eastern Pacific off the U.S. since late August 1971, ended operations. It had been sent by semigovernmental Marine Fishery Resources Development Center. Production totaled 3,532 cases (26.5 metric tons) of frozen squid, 14% of original estimate.

Area Surveyed

The survey ran north to south from off Vancouver to Baja California. It failed to locate good squid concentrations, except off Cape San Lucas (south of Baja California). There, two days of excellent catch yielded 2,140 cases. The squid taken off Cape San Lucas were described as large-size American common squid ("American o-surume ika"). These measured about 23 cm (9 inches) in body length. ('Suisan Tsushin', Dec. 27, 1971.)

DOLLAR-YEN REVALUATION DISTURBS FISHERY INDUSTRY

The Japanese yen has been revalued upward in relation to U.S. dollar: 308 to one, a rise of 16.88% over previous 360 to one. This has raised fears that a long recession is ahead.

Fears are growing that sales of high-value fish and shellfish--shrimp, squid, octopus, tuna, salmon, and ark shell-will slow and export profits shrink. Fishery operators have been making sufficient profits from high-value fish to offset losses from the declining catch, prolonged fishing trips, and rising labor costs. But if market weakens and prices decline, they will be in trouble. Another factor may contribute to disruption of market prices for high-value fish: the competition among importers. This is likely to intensify because of favorable import conditions created by the yen's increase in value.

Tuna Packers Hurt

The new monetary realignment will affect fishery exports. Tuna packers will be hit hardest. Their exports to the U.S. in 1970 were 53.6% of sales. Canned-tuna sales to the U.S. were temporarily suspended at the end of 1971 because of the decomposition problem. But when the problem ends and sales resume, it is unlikely that export prices can be raised to offset the 16.88% increase in yen's value.

Prices for canned tuna in oil exported to West Germany, Great Britain, France, and other European countries will also be difficult to increase "because of the traditional resistance among Europeans to price changes."

Canned Salmon Affected

Canned-salmon exports will be affected severely. The only outlet for canned red salmon is Great Britain. The yen value has risen 7.6% more than the pound, so sales negotiations will be difficult. Canned crab export also was uncertain at the end of 1971.

Frozen Tuna

Raw tuna supply remains unchanged--demand continues to outstrip supply--so frozen tuna prices for export likely will rise to offset yen-dollar change. ('Suisan Tsushin', Dec. 21, 1971.)

JAPAN (Contd):

BUILDS 10 FISHING VESSELS FOR ICELAND

Taito Seimo, a fish-net manufacturer, has received an order to build ten 500-gross-ton trawlers for export to Iceland. This is the first time any European country has ordered Japanese fishing vessels.

Iceland invited bids from foreign countries, including Japan, France, Norway, West Germany, and Poland to build thirty 500-ton and several 1,000-1,500-ton trawlers. The Japanese firm won the contract for the ten 500-ton trawlers primarily because it promised early delivery. The vessels are scheduled for delivery by the end of March 1972. ('Suisan Keizai Shimbun', Jan. 13, 1972.)

* * *

SHRIMPING OFF GUIANAS WILL EXPAND

Seven firms shrimping off the Guianas, South America, and several others have asked the Fisheries Agency to license 70 shrimp vessels. The 7 now operate 70 shrimpers. They plan to use 35 more because of the favorable outlook. The other firms interested in entering the fishery are seeking licenses for 35 vessels.

Began in 1959

Japanese shrimp fishing off the Guianas was started in 1959 by Sakiyoshi Gyogyo. It expanded. In 1967, seven firms were authorized by the Agency to conduct "experimental" fishing with one-year renewable licenses. At first, the firms had much difficulty because they did not know the grounds and there were labor-management problems. In recent years, however, many have been operating profitably.

The firms formed the South American Northern Coast Trawlers Assoc. and began negotiating with Guianan interests to construct freezing and processing plants at Georgetown, Guyana, and Paramaribo, Surinam. In October 1971, the Association formed its plans to establish a freezing and processing plant at Paramaribo. It hopes to conclude a contract with local interests by March 31, 1972. ('Suisan Keizai Shimbun', Jan. 11, 1972.)

* * *

SCIENTIST CAUTIONS AGAINST OPTIMISM ABOUT SKIPJACK

The 3-day tuna conference at Tokai University, Shimizu, Feb. 2, 1972, heard a government scientist urge caution in developing the skipjack resource. Moriya Anraku, Tohoku Regional Fisheries Research Laboratory, said the facts do not necessarily support the optimism in some quarters. His opinion runs counter to the Fisheries Agency's administrative policy for the fishery.

Anraku's Thesis

This is the substance of Anraku's statement: Some optimistic forecasts have been made about skipjack abundance, but close examination of catch fluctuations in the pole-and-line fishery reveals facts that do not necessarily support such optimism. For example, the abundance of skipjack off Japan has trended downward since 1965. In southern waters, operations are extending over wider areas; fishing is concentrated selectively on highly dense schools. Despite the extension of fishing grounds, the catch per unit of effort remains the same.

It is hoped that application of new fishing methods and development of new grounds will produce some increase in catch. However, the question whether this increase can produce greater economic gains must be examined closely along with the structural changes in the fishery and international implications. ('Katsuo-maguro Tsushin', Feb. 7.)

* * *

GYOGO WILL REPLACE TRAWLER LOST OFF NEW YORK

Taiyo Gyogyo, whose stern trawler 'Taiyo Maru No. 77' (1,800 gross tons) caught fire and sank off New York on Feb. 9, 1972, has decided to replace it. Construction of a 5,000-ton trawler, to be named 'Tenyo Maru No. 3', will be begun soon; completion is scheduled for February 1973. Meanwhile, 'Taiyo Maru No. 82' (2,400 gross tons), operating in the Bering Sea in mid-February, will be reassigned to the southern area trawl fishery (presumably the Atlantic). ('Suisan Keizai Shimbun', Feb. 15.

日本

NORWAY'S FISHERIES PROSPERED IN 1971

Again in 1971, Norwegian fisheries had a very prosperous year. Exvessel value rose 10% to a new high of US$220 million. The catch of 2.8 million tons was the second highest (1970: 2.7) but less than 1967's record 3 million tons.

Traditionally, the bulk of the catch has come from inshore or coastal waters. But, with rapid expansion in use of purse seines since 1965, distant operations have grown and offshore catches have increased.

Capelin Half of Catch

With decline in North Sea herring and mackerel stocks, more effort was directed toward capelin, which are caught mostly off North Norway. Capelin has become the leading fish in production of fish meal and oil. In the last two years, it was half the total catch. The 1971 capelin catch was the best ever: 1.4 million tons worth US$39 million.

Fish Meal Up

Fish meal production is considerably above 1970. Output of fish oil will total about 179,000 tons. A factory fleet off West Africa also caught 200,000 metric tons of sardinella and mackerel, which were processed into fish meal.

Cod, Herring, Brisling

In 1971, the important cod fisheries yielded a record 341,000 tons worth US$78.6 million. The herring catch was 300,000 tons worth US$20.7 million. Previously, herring had formed the greater part of the catch; now they are in relatively short supply. Not many years ago, the winter herring fisheries off Norway yielded several hundred thousand tons annually. In 1971, the catch of winter herring was only 6,894 tons, fat herring 12,944 tons, and "small" herring 2,248 tons. Until recently, the main herring catch came from the North Sea; stocks there have declined drastically. The 1971 North Sea herring catch was down to 210,399 tons. The catch of brisling, mainstay of Norway's important fish-canning industry, was about 9,000 tons, down 30% from 1970.

Protecting Herring

Norway has agreed with other countries to prohibit catches of winter herring in 1972 and to reduce catch of fat and small herring to 45% of 1969 catch. A closed season for herring fishing from April 1 to June 15 has been established.

Record Exports

Exports of fish and fish products are estimated at record earnings of about $314 million.

The Industry

About one percent of Norwegians are fishermen (43,000). They operate 36,000 fishing vessels, of which 27,000 are small open motor vessels. Also, many Norwegians work in fish processing and auxiliary trades. (The Export Council of Norway, and U.S. Embassy, Oslo.)

ICELAND IS BUILDING 21 STERN TRAWLERS

The Icelandic Government is fostering a program to strengthen its fisheries. As part of this, contracts have been negotiated to build 21 stern trawlers, 500 to 1000 tons, totaling 14,000 GRT. Government and private investment will be nearly US$30 million.

Many of the new vessels are to be built in Spain; 7 in Norway, 2 in Poland, and some in Iceland. This is the first recruitment to this fleet since 1969. Delivery is slated for 1972-73.

Situation and Outlook

The failure of Iceland's herring fisheries in recent years has renewed interest in trawling. In 1970, groundfish catches were the largest since 1960; good catches are expected to continue into 1972.

Favorable prices for groundfish have strengthened the financial status of the vessel owner-operators. So they are encouraged to better equip their fleet.

The principal fishing grounds have been in Icelandic coastal waters, mainly along the south and west coasts. The newer vessels will be capable of fishing distant waters.

Government Loans

The fleet modernization, which began in 1970, is supported by government loans. Loans available from the Fisheries Fund may cover three-quarters of the vessel cost if the vessel is built at home, and two-thirds if built abroad. Interest rates are established by agreement between the Ministry of Finance and the Central Bank of Iceland. All loans are guaranteed with a first mortage on the vessel. (U.S. Embassy, Reykjavik.)

NORWAY'S FIRST PURSE SEINER TO FISH TUNA OFF AFRICA

Norway's first tuna purse seiner, the 'Sun Tuna', has been delivered to A/S Sun Tuna & Company in Aalesund. It is a former 216-foot whale catcher rebuilt in Norway.

The vessel's freezing equipment has a maximum daily capacity of 100 metric tons of fish. Total loading capacity is 900 tons.

It will carry two purse seines, one among the largest ever made in Norway: 1,640 yards long, 220 yards deep, and covering 75 acres of sea.

The 'Sun Tuna' will fish off Africa and land its catch directly in Italy. (U.S. Embassy, Oslo.)

DENMARK EXEMPTS PROCESSED SHRIMP & HERRING FROM 10% IMPORT SURCHARGE

On Oct. 20, 1971, Denmark imposed a 10% import surcharge on all prepared and preserved fish products, including frozen cooked shrimp, a principal U.S. export to Denmark. On November 24, Denmark exempted prepared and preserved shrimp, among other items.

The exemption will permit continued expansion of the sale of Maine and Alaskan shrimp to Denmark. Another item exempted was prepared or preserved herring, whole or filleted. (U.S. Embassy, Copenhagen.)

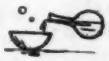
FRENCH TO TEST PROTEIN FROM PETROLEUM

A plant to test a commercial process for manufacturing protein from petroleum will start operation near Marseilles. It will have a 20,000-ton annual capacity plant. If it proves successful, a 150,000-ton-capacity plant will be constructed in about 5 years. Operator is Soviete Francaise de Petroles B.P.

Present speculation is that project's protein output will compete with such proteins as fish meal. The protein from petroleum is 70% pure. Experiments have indicated no adverse effects on growth or meat quality of test animals. A uniform product is assured by adding carefully developed strains of yeast and basic chemical compounds to petroleum.

Differs from U.S. & British Work

The French process differs from U.S. and British experiments, which first separate paraffins from petroleum. Research is being conducted with the World Health Organization into possible uses for fortifying human food. (Agric. Att., U.S. Embassy, Paris.)



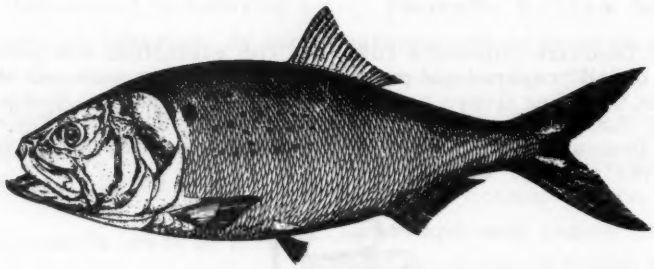
ITALY SETS STRICTER MERCURY TOLERANCE LEVEL

Italy has revised its ordinance concerning mercury in fishery products, reported the Japanese newspaper 'Suisan Tsushin' Jan. 18. Effective until Dec. 31, 1972, it establishes a new tolerance level of 0.7 part per million (ppm) of total mercury content in fish. The previous limit was 1.0 ppm; its 3-month period expired Dec. 14, 1971.

New Regulation

The new regulation allows foreign fishery products to enter Italy without sampling at the port if accompanied by a government inspection certificate of the exporting country. The certificate must state mercury content does not exceed 0.7 ppm. If there is no document, the product will be sampled by an Italian testing laboratory.

FOOD FISH FACTS



MENHADEN

Atlantic (Brevoortia tyrannus)

Gulf or largescale (Brevoortia patronus)

Menhaden, also called pogy, mossbunker, or fatback, are members of the herring family. Although seldom used for human consumption, menhaden are of great industrial importance. These fish have a tendency to school according to size and age. This habit, varying from hundreds to thousands of individuals in a school, makes netting them relatively easy for fishermen.

In calm weather menhaden in vast schools may be seen lifting their snouts up out of the water as they feed and they occasionally break through with their top fins and tails. These large groups of fish are a sight not easily forgotten as they swim together side by side, tier above tier, in perfect unison. The schools are often so dense they seem to darken the surface like great cloud shadows hovering over the waters of the Atlantic and Gulf Coast.

DESCRIPTION

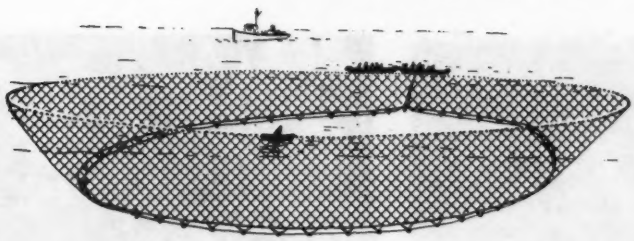
Menhaden vary in color from dark blue to green, blue gray, or blue brown above and have silvery sides, belly, and fins with a yellow or brassy luster. There is a conspicuous dusky spot on each side of the fish behind the gill openings followed by a varying number of smaller dark spots. They are somewhat flattened sidewise like other members of the herring family and the body is about three times deep as long. The scaleless head is very large in proportion to the body. The body scales are nearly vertical (not rounded) and are edged with long comblike teeth instead of being smooth. The large gaping mouth is toothless and the lower jaw projects beyond the upper. The tail is deeply forked. Menhaden feed on microscopic plants and small crustaceans which are sifted out of the water with highly specialized, sievelike gill rakers. Adults average from $\frac{1}{2}$ to 1 pound in weight and from 12 to 15 inches in length.

HABITAT

Menhaden occur in temperate waters along the coast of North America. Atlantic menhaden are found from Nova Scotia to central Florida. Gulf menhaden occur from southern Florida to Veracruz, Mexico. They are not equally abundant throughout their range but are concentrated in certain localities during certain periods of the year. They live in near-surface waters over-lying the inner half of the Continental Shelf during the warmer months. They are rarely seen in surface waters during the colder months and there is evidence that during this period they live in deeper waters over the Continental Shelf. Although they have a definite pattern of migration, menhaden are found at all times of year in Chesapeake Bay.

MENHADEN FISHING

The menhaden fishery is one of the oldest industries in the United States. History records that Indians taught early settlers to place a fish in each hill of Indian corn. It is not known whether all of the settlers followed this practice. The information, however, did lead to the utilization of menhaden for soil enrichment when crops became poor. Use of menhaden as fertilizer was the first stage in



Menhaden
Purse Seine

the development of a fishery which was to become the largest in North America.

Menhaden are caught with purse seines operated from two open seine boats. When laying the seine, the boats separate and the net is laid out as each boat completes a half-circle. When the school is surrounded, the bottom of the seine is closed or "pursed" confining the fish. The ends and bottom of the seine are hauled in and the catch is pumped into the hold of the carrier vessel standing by. Since 1946 airplanes have been used extensively in locating the schools of fish. This practice of directing the laying of the seine around a school of menhaden from the air by radio communication between the pilot and the fishing captain has been universally adopted. A smaller amount of menhaden are caught in pound nets. This catch is incidental, however, as the pound nets are usually set for other species.

CONSERVATION AND MANAGEMENT

Scientists of the United States Department of Commerce's National Marine Fisheries Service, the Virginia Institute of Marine Science, and of several other state agencies along the east coast have done extensive research on menhaden over the past years. Information concerning life history, migrations, growth, and mortality has been gathered. Studies have been made of the causes of fluctuations in abundance and techniques developed for predicting the density of populations. Increased fishing and declining catch in recent years have raised serious questions about the need for management of this valuable resource. Fishing regulations have been in effect for several years. Continuing research, tagging experiments, offshore fishing for older menhaden, and investigations into the commercial potential of two closely related species are a part of the conservation and management plans of concerned scientists.

USES OF MENHADEN

Menhaden are a valuable part of our economy. The catch is processed into fish meal, oils, and solubles and these products are used in dozens of ways. The meal, high in protein, minerals, and other essential nutrients, is excellent as an additive for the feeding of hogs, poultry, mink, and other animals. The oils and solubles are used in the manufacture of paints, putties, resins, lubricants, caulking compounds, brake blocks, soaps, cosmetics and other pharmaceuticals, and for tanning leather. This fishery provides employment for thousands of people, not only on the vessels and in the processing plants, but all through hundreds of related industries. (National Marketing Services Office, NMFS, U.S. Dept. of Commerce, 100 East Ohio Street, Room 526, Chicago, Ill. 60611.)

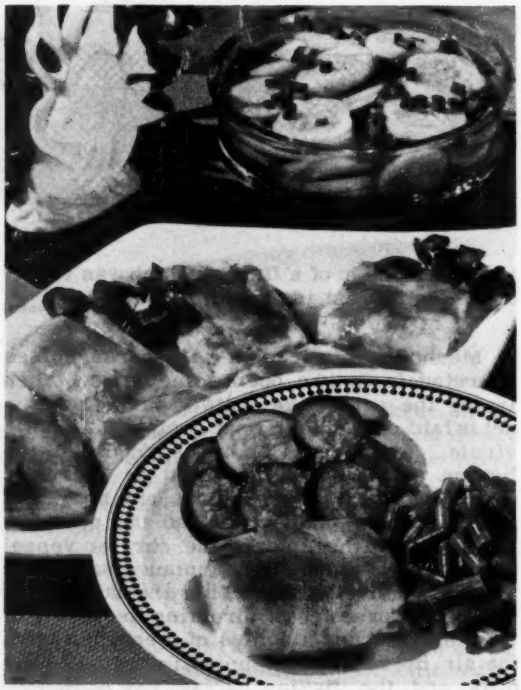
SLIM AND TRIM WITH SUCCULENT SEAFOOD

So, you've been trying to "diet in quiet" as Odgen Nash humorously advised, but you're discouraged. Those unwanted pounds aren't disappearing fast enough, and the waistline bulge is still spoiling the fit of your clothes. It has been said that "misery loves company," but you don't believe it, and you're about ready to quit. Doctors and nutritionists, aware of the difficulties of dieting, would assure you that you shouldn't give up, because there is a way to lose weight and increase vitality at the same time. Here's how--explore the wonderful world of fish and shellfish.

Eliminate your negative thoughts and set sail on a diet routine that accentuates the positive. Fishery products can slim and trim you while you enjoy every luscious bite. The reason is that seafood are high in valuable protein, vitamins, and minerals, while being low in sodium, fat, and calories. Choose recipes planned for dieters, not those loaded with butter or sauces. Give versatile seafoods a chance to prove their worth. It won't be long until you want to tell the whole world about the values of fish and shellfish in the diet.

Begin your positive diet routine with a tasty entree that offers a maximum of flavor with a minimum of calories. Spicy Seafood, a taste delight from the National Marine Fisheries Service, is a diet dandy with only 130 calories per serving. This easy-do recipe offers you a choice of thick fish fillets such as cod, pollock, or, if you prefer, choose halibut or snapper. Marinate the tender fillets for about 30 minutes in a zippy sauce made from tomato juice accented with a touch of vinegar and highlighted with old-fashioned French dressing mix. What could be simpler? Baste the fillets with the remaining sauce while they broil--just long enough to flake easily. This satisfying entree has the ultimate in flavor and taste, and you'll want to serve it again and again long after you've lost those extra pounds and no longer need to diet.

Losing weight can be a satisfying experience with Seafood Slimmers (I 49.49/2:7), Fishery Market Development Series No. 7. This full-color booklet is chock-full of tasty seafood recipes for any day of the week and any meal of the day. For your copy send 25¢ to the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.



SPICY SEAFOOD

2 pounds cod or other thick fish fillets, fresh or frozen

$\frac{2}{3}$ cup tomato juice

3 tablespoons vinegar

2 tablespoons salad oil

1 envelope ($\frac{5}{8}$ ounce) old-fashioned French dressing mix

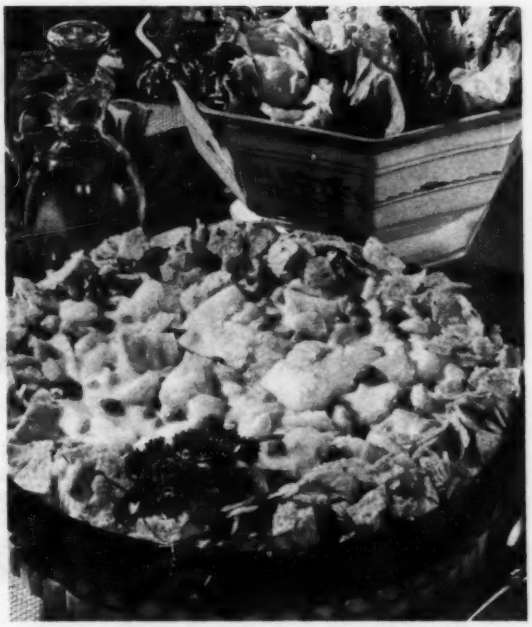
Thaw frozen fillets. Skin fillets and cut into serving-size portions. Place fish in a single layer in a shallow baking dish. Combine remaining ingredients and mix thoroughly. Pour sauce over fish and let stand for 30 minutes, turning once. Remove fish, reserving sauce for basting. Place fish on a well-greased broiler pan. Broil about 4 inches from source of heat for 4 to 5 minutes. Turn carefully and brush with sauce. Broil 4 to 5 minutes longer or until fish flakes easily when tested with a fork. Makes 6 servings.

(National Marketing Services Office, NMFS, U. S. Dept. of Commerce, 100 E. Ohio St., Rm. 526, Chicago, Ill., 60611.)

FISH FLIPS WITH CHIPS

Casting about for something tasty and new to serve? If you've been limiting your family with the same old tired menus, and your excuse is that the food money always runs out before the month does--you need a new approach. Would you like to find a food source that has infinite variety and is loaded with valuable protein and other nutrients; something tempting to eat, easy to prepare, and kind to the budget? That is a large order--but it isn't too hard to fill. The National Marine Fisheries Service says that all you need is a little imagination and a supply of fish and shellfish to spark appetites, satisfy hunger, and add variety as well as nourishment to meals. Versatile seafoods are the answer--and there is an abundant supply available at your seafood market or the frozen seafood counter at the supermarket. Fishery products come in a myriad of seafood styles to fit every taste and need ranging from budget to gourmet items. The vast majority of fishery products, however, are moderately priced. Prices are usually determined by the abundance of the species, the quantity caught, and the amount available. Wise homemakers note what is in good supply and buy accordingly.

Fish fillets, those tender pieces cut from the sides of the fish, are among the most economical of all fishery products because there is very little waste. Many varieties of fish fillets are available, and there are so many tasty ways to prepare them that one could serve this seafood style for weeks without repeating the same entree. Fish fillets may be broiled, baked, steamed, fried, poached, or combined with other foods in a satisfying entree such as a Seafood Casserole With Corn Chips. This casserole is unusual because it features succulent fish fillets combined with mushrooms, sauteed onions, peas, and--here's the something new--corn chips for crispness and body. Cream of shrimp soup blends it all together and adds a subtle flavor that will keep your eager eaters guessing and coming back for more. Try this man-pleasing recipe soon; it's so easy to do and just right when appetites are big and food funds are little.



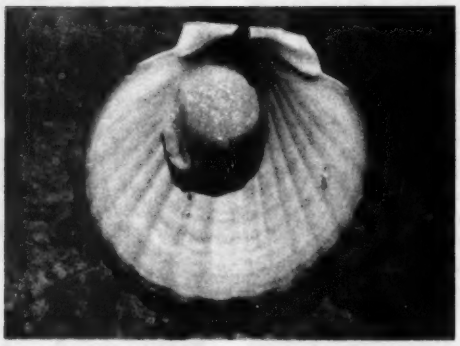
SEAFOOD CASSEROLE WITH CORN CHIPS

- 2 pounds cod or other thick fish fillets, fresh or frozen
- ½ cup chopped onions
- 3 tablespoons melted margarine or cooking oil
- 2 tablespoons flour
- 1 teaspoon salt
- 1 can (10 ounces) frozen condensed shrimp soup, defrosted
- ½ cup half-and-half (half milk, half cream)
- 1 can (4 ounces) sliced mushrooms, undrained
- 1 package (10 ounces) cooked frozen peas, drained
- 3 cups corn chips

Thaw frozen fish. Cut fish into 1-inch pieces. Cook onions in melted margarine or cooking oil in a 10-inch fry pan until tender but not brown. Add fish and cook, turning carefully until it is firm. Sprinkle with flour and salt. Add soup, half-and-half, and undrained mushrooms. Heat and stir carefully. Fold in peas. Spread 2 cups corn chips in even layers over the bottom of a shallow, 2-quart round casserole or a 12 by 8 by 2 inch rectangular baking dish. Add fish mixture. Sprinkle remaining corn chips around edge of dish. Bake in a moderate oven, 350° F., 25 to 30 minutes or until mixture is hot and bubbles around edge. Makes 6 servings.

(National Marketing Service Office, NMFS, U.S. Dept. of Commerce, 100 East Ohio Street, Room 526, Chicago, Ill. 60611.)

FOOD FISH FACTS



SCALLOP MEAT AND SHELL

Throughout the centuries many romantic and historical events have evolved with the beautiful scallop shell as a symbol. Buildings in ancient Pompeii were ornamented with scallop shell designs. During the Crusades scallop shells were the symbol of the holy pilgrimages and one European variety is still referred to as "the pilgrim" or "St. James' shell." Poets have written about their beauty and artists so admired their symmetry and grace that they were often used in paintings of Venus and the name "Venus-cocle" came into common usage in Old English.

Early American Indians of the Pacific Northwest used scallop shells in their ceremonial dances and some tribes used them as ornaments. Today the shells are eagerly sought by collectors. The larger shells are frequently used as practical, individual containers for cooking and serving fish mixtures.

Inside the scallop shell is another work of art that is also a source of eating pleasure to all people who love good food from the sea.

DESCRIPTION

The name "scallop" aptly describes the fluted edges of the fan-shaped scallop shell. The shells of young scallops, in particular, are beautiful; the outside is delicately colored, sometimes having pink and white or other darker color variations. The inside of the shells is pearly-white and has a satiny luster.

Scallops, like clams and oysters, are mollusks having two shells. They differ, however, from those shellfish in that they are active swimmers. The scallop swims freely through the waters and over the ocean floor by snapping its shells together. This action results in the development of an oversized muscle called the "eye" and this sweet-flavored muscle is the only part of the scallop eaten by Americans. Europeans, in contrast, eat the entire scallop meat.

The New England sea scallop (Placepecten magellanicus) is the most commercially important scallop in the United States. It has a saucer-shaped shell and grows as large as 8 inches in diameter with the muscle or "eye" sometimes reaching up to 2 inches across.

The bay scallop is much less plentiful but greatly desired by scallop fanciers. It reaches a maximum size of about 4 inches in diameter with the muscle or "eye" about $\frac{1}{2}$ inch across. The bay scallop shell is similar to that of the sea scallop except that it is smaller, more grooved, and the edges are more serrated or scalloped.

DESCRIPTION (Contd.)

A number of important new scallop beds have been found recently through National Marine Fisheries explorations. The calico scallop, located off Florida and in the Gulf of Mexico, is closely related to the bay scallop although slightly larger. It gets the name "calico" from the mottled or calico appearance of the shells.

Particularly exciting has been the discovery of a new and potentially important source of sea scallops in the cold waters surrounding Alaska. This species, found as far south as Oregon, is a different variety of sea scallop than that found in New England waters.

HABITAT

Sea scallops from the east coast are taken from the deep waters of the Northern and Middle Atlantic States, with the old whaling port of New Bedford, Massachusetts claiming most of the catch. This is still the largest source of supply.

Bay scallops live in bays and estuaries from New England to the Gulf of Mexico.

SCALLOP FISHING

Sea scallops are harvested with dredges on gravel, sand, or sand-mud bottoms. Some trawl fishermen harvest scallops on a part-time basis. This necessitates removing the otter trawl nets and bringing aboard the equipment needed for scallop dredging.

Bay scallops are taken with small dredges operated from small boats or scows in deeper bay waters. In shallow water bay scallops are usually taken with dip nets, rakes, or by hand.

Scallops cannot close their shells tightly and die soon after being taken from the water. Because of their perishability scallops are shucked aboard ship as soon as they are caught, and the meats are iced.

CONSERVATION AND MANAGEMENT

The supply of scallops has decreased in some areas in recent years. Many factors affect their abundance, some of which are beyond man's control. Studies are being made to correct this problem through grant-in-aid legislation passed by Congress, the Commercial Fisheries Research and Development Act of 1964. Through research and explorations it is hoped that a continuing and abundant supply of scallops can be provided for an ever-growing population.

USES OF SCALLOPS

The tender, succulent meats from either bay or sea scallops have no waste and can be used interchangeably. All scallop meats are excellent sources of protein, have many of the vitamins and minerals valuable in good nutrition, and are low in fat. The delicately-flavored nuggets of meat are available throughout the year either fresh or frozen. (National Marketing Services Office, NMFS, U.S. Dept. of Commerce, 100 East Ohio Street, Room 526, Chicago, Ill. 60611.)

INDEX

BACK COVER: Madagascan child unloads Pirogue. Fish are taken home, strung out in long lines to dry in the open, and then sold. (FAO: P. Pittet)

UNITED STATES
GOVERNMENT PRINTING OFFICE
PUBLIC DOCUMENTS DEPARTMENT
WASHINGTON, D.C. 20402